October 1, 1939

VOLUME 101 **NUMBER 1**

A Bill Brothers Publication

INDIA RUBBER WORLD

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M. L. WULFORST, CIRCULATION MANAGER

S. R. HAGUE, ASSISTANT EDITOR

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INDIA RUBBER WORLD

Published at 420 Lexington Avenue, New York, N. Y.

Volume 101 **New York, October 1, 1939** **Number 1**

1889—1939

THE Service rendered to the rubber industry by INDIA RUBBER WORLD, completes a span of fifty years.

This paper, which was founded, on October 15, 1889, by Henry C. Pearson, F.R.G.S., was dedicated by him to the dissemination of vital information and news concerning the rubber industry. From its first issue, it is our honest opinion that Mr. Pearson faithfully carried out this principle.

In 1926 Mr. Pearson's failing health necessitated that he retire from the active participation in publishing the paper. He, like all others who have founded a worthwhile enterprise, desired most of all that the paper be continued on its high editorial plane and develop even further as the industry itself expanded. Therefore, we felt highly honored when he placed this trust in our hands some 12 years ago.

During our control of the INDIA RUBBER WORLD we have, to the best of our ability, continued to publish a magazine based on the same high ideals and dedicated to the same fruitful purpose. The fact that, after more than a decade of our management, the paper not only retains the eminent position established by Mr. Pearson, but has continued to grow in both importance and circulation, is proof that we have been worthy of the confidence placed in us by the founder.

We take this opportunity to thank William M. Morse, editor emeritus, and Webster Norris, retired technical editor, for their untiring devotion to the publication during the several years they continued with INDIA RUBBER WORLD after Mr. Pearson severed active management and the paper had come under our jurisdiction.

In closing we, on behalf of the entire staff of the publication, wish to renew our pledge to continue to produce a publication which will be worthy of the great industry which it serves.

Bill Brothers Publishing Corp.

Edward Lyman Bill, President B. Brittain Wilson, Vice President

Fifty Years of Continuous Service

WITH the publication of its initial issue on October 15, 1889, India Rubber World began its existence as the first American medium for disseminating technical and trade information to the rubber industry. This journal has enjoyed an uninterrupted and regular monthly performance of the purpose and obligation with which it was endowed by its founder fifty years ago. From its inception it has experienced international acceptance and has had contact whereby the publication of important information pertaining to activities in rubber throughout the world has been possible.

The original aims and objectives, which have continued to be uppermost in the minds of the publishers and staff throughout the half century, are best presented by quoting from the "Announcement" on page 1, Number 1, Volume 1.

"The initial plan laid out in these columns, and still to be improved upon as occasion and space offer, shows the result of a careful survey of the field by a corps of editors alike capable and devoted to the interests of the new enterprise. It aims to embrace all procurable information regarding the uses of india rubber and gutta percha in the arts and manufactures. . . .

"We propose to aid materially the scientific and mechanical development of business in india rubber, gutta percha, and kindred products, by giving the manufacturer all meritorious information procurable as to old and new methods and compounds. Experience gained at different mills, and knowledge acquired directly and indirectly as to the workings of factories here and elsewhere, proves false the generally accepted belief and oft-vented statement that all rubber manufacturing channels are still guarded by really valuable and permanent secret processes. The trade has, in fact, of late years, through the keenness of competition in nearly all departments, made too rapid strides to admit of lasting, important secret changes in any one branch, and, in this respect, the rubber industry is, like many others, equally progressive.

"As has been shown, more particularly by Chandler, Blossom, Bolas and Grimshaw, comparatively little is yet known of the chemical constitution of caoutchouc as well as of its very many possible chemical combinations, and, this being the case, we shall take pains to add in every way to the store of the rubber worker by obtaining and detailing the result of practical experimentation according to satisfactory formulas and desirable patented processes.

"Besides keeping pace with new inventions, we shall gradually publish all claims attaching to patents of india rubber and to its sub classes heretofore granted in the United States and Canada, as well as in France, Belgium, Germany and Great Britain.

"For the especial benefit of the jobber and retailer, every effort will be made to secure the prompt transmission to us of all particulars of new goods introduced in the market from month to month.

"Upon one point we are anxious there should be no misunderstanding whatsoever: The reading and editorial pages of this paper are not for sale. Advertisements will appear only in the departments that are avowedly devoted thereto, and whatever is a paid announcement will always honestly be put before our readers as such.

" . . . We earnestly invite correspondence as well as the interchange of views from manufacturers, scientists, and all others interested in the scope and success of this publication."

Until the time when in 1926 Henry C. Pearson, F.R.G.S., (1858-1936) relinquished his active association with publication duties and even to this day, the names Pearson and India Rubber World have had a synonymous meaning to those in the rubber industry. Having been associated with the Tyre Rubber Co. prior to 1889 and later traveling widely, Mr. Pearson acquired a worldwide knowledge and acquaintanceship, and under his guidance the publication rapidly assumed the position of a recognized medium for the authentic recording of noteworthy developments and other activities within the ever-growing rubber industry. The continuity of regular service by and the increasing acceptance of this journal are mute testimony of his successful attainment of his life objective. The policies and traditions so well established were carried on after the cessation of Mr. Pearson's active connection and still remain as the guiding factors in present-day conductance of this publication's relations with the rubber industry.

Also familiar to the readers of India Rubber World are two men, William M. Morse and Webster Norris, who, for many years, put into practice the aims and ideas of Mr. Pearson and later succeeded to the editorial responsibility. Mr. Morse, a close associate and friend of Mr. Pearson went to Panama in 1903, in connection with the acquiring of a 500,000-acre tract of Castiloa Elastica bearing land for a Boston company. During this and subsequent years he reported for the columns of India Rubber World, and in 1912 he made another trip to Panama, the West Indies, and neighboring territories as the direct representative of India Rubber World. In succeeding years Mr. Morse was directly associated with the staff of this journal and became editor in 1920 in which capacity he acted until July 8, 1935, when he retired from active duty. Webster Norris, who was first identified with rubber on July 18, 1887, as the first chemist of the Boston Rubber Shoe Co. and who prior to 1890 developed an instrument for gaging rubber sheets, continued in technical work for private rubber companies until 1917 when he became technical editor of India Rubber World and after which he also conducted a consulting business. For many years prior to his direct

connection as a member of the staff he recognized the value of the journal to the rubber chemist and superintendent, and he frequently contributed articles to its columns. Throughout the fifty years of existence the editorial staff of this journal has been composed of men with a practical and technical knowledge of rubber.

The year 1889, in which India Rubber World was founded, marks the half-way mark between the present day and the discovery of vulcanization of rubber by Charles Goodyear. In this year 1939 two events notable in the American history of the rubber industry are being commemorated in the form of: the centennial of the discovery of vulcanization and the consequent founding of the rubber industry; and the golden anniversary of India Rubber World, the first American medium for the public exchange of information relating to rubber.

Inasmuch as the latter would not have been possible without the occurrence of the subject of the former celebration, it appears fitting that the theme of this issue should be concentrated on both events and the fifty-year period intervening. Although some of the pages which follow deal with events in the present century, the subject matter has a definite relation to the early history of the rubber industry and the accomplishments during the nineteenth century. Probably the greatest factors in attaining the now-recognized influential position of rubber, all of which have been developed to their present status during the past four decades, include: the application of rubber in the form of pneumatic tires to the automobile; the discovery and adaptation to manufacturing procedure of such advancements as organic accelerators, antioxidants, preserved latex, and other products of research which have had a pronounced effect upon the technique of modern vulcanization; and the organization, to promote exchange in technical information, of the rapidly increasing body of rubber chemists into a group now known as the Division of Rubber Chemistry, American Chemical Society.

On the other hand a number of old timers will recall the equipment, the methods of compounding and production, and the products developed during the late nineteenth century. The work of those early years, performed in a practical way and without thought of chemical reactions, constitutes an era in the history of rubber which is not too distant, but is sufficiently removed from present practice to be of extreme interest today.

Purposely in this jubilee number no attempt has been made to treat in detail the developments during the past fifty years, but rather to recall the conditions at the time of the initial issue which, when compared with the present well-known practices, will accentuate the rapid advancement in late years which has enabled the rubber industry to assume its present prominent position.

The editorial staff appreciates the spirit of cooperation which has made possible this journal's continuous record and will always strive to extend its usefulness to the industry.

S. C. Stillwagon

Editor

Early Rubber Pioneers

As THE years pass, the outstanding discoveries in rubber fall into longer perspective and their importance is lost in the industry's rapid development of recent years. This is particularly true with Charles Goodyear's discovery of sulphur or "hot" vulcanization which transformed an intractable raw material into serviceable products of world-wide utility.

Closely following Goodyear's experiments, Parkes, of England, immersed a sheet of raw rubber into sulphur compounds, thereby disclosing the cold vulcanizing process. Thus two different methods of vulcanization became known.

In the years following these basic discoveries the study of sulphur absorption in vulcanized rubber was actively pursued by rubber research chemists, and Carl Otto Weber will always be remembered as the leading investigator.

In the commercialization of these basic experiments many fundamental processes were developed in the manufacture of rubber products. Undoubtedly the discovery and first use of organic accelerators in vulcanization by George Oenslager, under the direction of Arthur H. Marks, have been the most outstanding advancement and are destined to be as important in the evolution of rubber as Goodyear's disclosures.

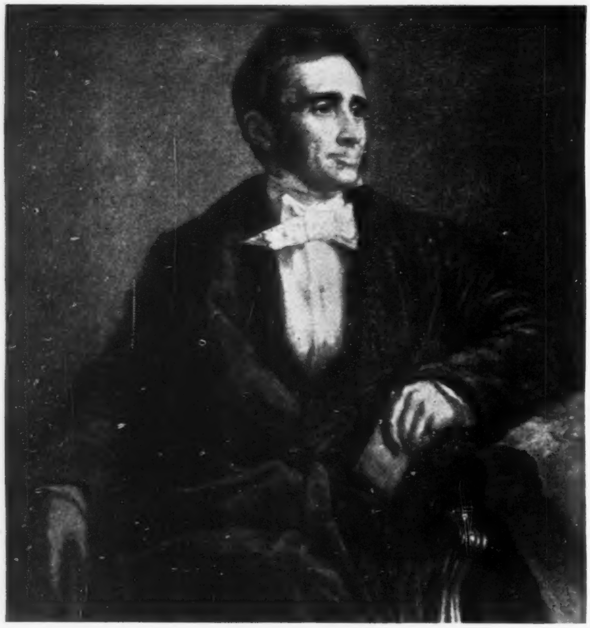
While memorializing the pioneers of far-reaching achievement in rubber chemical research, the botanist who pioneered the culture of *Hevea* rubber should be equally commemorated. Henry A. Wickham brought seeds from the Amazon River to Kew Gardens in London, England, where they were successfully sprouted, and the seedlings sent to the Botanical Gardens in Ceylon. Thus was founded the rubber plantation industry that gives to the world an unfailing supply of rubber and liquid latex. Wickham was knighted in recognition of his services.

Rubber chemists, physicists, and technologists continue the search for new processes and materials for the production of better rubber products, and a retrospect of their achievements in the next decade will undoubtedly reveal many discoveries of great importance to the rubber industry.

W. M. Morse

Editor Emeritus

Charles Goodyear, the Persistent Researcher



Charles Goodyear—1800-1860
(Reproduced from a Painting on Hard Rubber by P. G. A. Healy)

H. E. Simmons[1]

WORTHY of great note are the prophecies in the work of Charles Goodyear and the analogies which exist between his experiences and those of the industry which his discovery made possible.

It does not require much elapse of time for us to recognize the importance of certain types of discoveries, and for others it takes a long interval to appreciate fully the contribution which has been made. The invention of the steam boat, the cotton gin, the telephone, the airplane did not require much in the way of time to make illustrious Fulton, Whitney, Bell, and the Wright brothers, but the discovery of such an academic principle as the vulcanization of rubber has required the passing of a century before its full significance is appreciated, and this year we pause to give true recognition to the discoverer, Charles Goodyear.

The substance, rubber, has been referred to in the literature from the time when Condamine, about the middle of the eighteenth century, appeared before the French Academy and reported some of his observations in South America when he saw the natives using various articles made from rubber. Dr. Joseph Priestly first recorded the fact that this substance would remove lead pencil marks from paper, and because he thought it came from the West Indies, he named it "India rubber." On May 2, 1791, the first English rubber patent was granted to Samuel Peal. It was for a process of waterproofing fabrics and the making of boots and shoes.

The first rubber company was incorporated in America in 1832. The incorporators were Lemuel Blake, Luke Baldwin, Edwin M. Chaffee, and Charles Davies, Jr. The company was known as the Roxbury India Rubber Factory to manufacture India rubber cloth, leather, and other India rubber goods. It was capitalized at $30,000 and in 1835 increased to $300,000. Other companies were incorporated at Boston, South Boston, Chelsea, Woburn, Framingham, New York City, Staten Island, and Troy. All of these failed as did the original one at Roxbury and all for the same reason. The rubber would harden like metal in the winter and soften and run in the summer. Imagine raincoats, boots, and suspenders made of such a material!

To solve this difficulty was the problem which confronted those interested in making rubber goods. And it was the solution of this difficulty by Charles Goodyear which causes us to honor him today. He was born in 1800 and, while a school boy, he became very much interested in rubber which he obtained from some of the traders who were returning from South America.

When he was seventeen years old he went to Philadelphia and worked four years with a hardware firm. In 1826 he opened in Philadelphia a hardware store in which he was very successful for a few years. His health failed, and in 1830 his business failed also. Under the existing laws he was repeatedly arrested and put into jail for nonpayment of his debts.

It was in Philadelphia in the kitchen of his little cottage that he experimented with rubber, attempting to remove those properties which caused it to soften when warm and get brittle when cold. One of the first materials he tried was magnesia, and he mixed this into rubber with the aid of his wife's rolling pin on a marble slab. This he found did dry up the surface of the rubber. With this mixture he made up some shoes, but they all deteriorated in warm weather. To pay his bills he sold his small amount of furniture and moved his family to the country, while he went to New York.

Here he tried boiling his mixture of rubber and magnesia in lime to remove the stickiness, and with this process he was sure he had solved the problem. To test his products he always wore some piece of apparel made from it and so the story started—

"If you meet a man who has on an India rubber cap, stock, coat, vest, and shoes, with an India rubber purse, without a cent of money in it, that is Charles Goodyear."

He next tried to ornament some of his lime boiled drapery with bronze powder. It was not successful; so he tried to remove the bronze with nitric acid. This was a mess, and he discarded it, but a few days later when he examined it he found that the surface had lost its stickiness, so again he became enthusiastic, and he took out a patent June 17, 1837 on what he called his "acid gas process."

William Ballard aided him in starting a factory in New York using this process, and it failed in the panic of 1837-1838. This left Goodyear so poor that he was compelled to give his umbrella for passage on the ferry from Staten Island to New York.

He finally went back to Roxbury and was able to sell a few licenses for the use of his "acid gas process" and then

[1] President, University of Akron, Akron, O.

realized a few thousand dollars; so the family was cared for again.

In 1838 Goodyear met Nathaniel Hayward who had discovered that if sulphur was dusted on the surface of rubber and then exposed to the sun, the stickiness was reduced; so Goodyear induced Hayward to patent this in February, 1839, to be known as the "solarization process." Here we find the first evidence of a recognition at least of the essentials necessary to correct the faults inherent in rubber: namely, rubber, sulphur, and heat.

Hayward and Goodyear continued to work together, and they received an order for 150 mailbags from the government which they made by the "acid gas process," and all of them decomposed before they were delivered. As a result of this adventure, he lost everything and was again discredited by all his friends and associates. He was not discouraged and he continued his work with the same spirit that motivated Paul when he exclaimed, "This thing I do."

Many stories have been told of his real discovery, but we assume that the true story was told by Goodyear himself. He made a visit to Woburn and while there experimented in an idle factory with the effect of heat upon a mixture of rubber and sulphur. He observed that the rubber did not melt, but charred like leather. He took his family to Lynn so that he might use the steam power of Messrs. Baldwin and Haskins for further experimenting. But he soon returned to Woburn and continued his work, and here it was that the real discovery was made. When he heated rubber and sulphur, he had a new substance that was not affected by heat or cold or the ordinary solvents of rubber.

With the process fairly well established he was still an object of charity. In fact it was here that he pawned his children's school books for the sum of $5.

He went to New York and discussed his new product with William Rider who then made it possible for Goodyear to do more experimenting with the objective of perfecting the process. But again misfortune befell him when the Riders failed. In the meantime he had developed a process for making shirred goods which gained the interest of his brother-in-law, William DeForrest, who advanced him money over a period of a few years, amounting to $46,000 which Goodyear never was able to repay. Again in the midst of his operations he was arrested for debt and placed in a Boston jail. It was on this occasion that he went through bankruptcy.

He prepared the specifications for a patent on December 6, 1841, and deposited them with the Patent Office. His actual application for a patent was made in 1843 and on June 15, 1844, it was granted.

Some samples of his products fell into the hands of Hancock in England, who, after close examination, recognized the use of sulphur and proceeded to obtain English patents for himself and was successful in defending his claims in the English courts in 1851 and 1855.

Goodyear was torn between two impulses, one to manufacture and the other to continue his research to find new uses for his material. He finally settled down to do the latter. He was a poor business man and manufacturers took advantage of him.

United States Patent Commissioner Holt said, "—no inventor probably has ever been so harassed, so trampled upon, so plundered by that sordid and licentious class of infringers known in the parlance of the world, with no exaggeration of phrase, as 'pirates.' The spoilation of their incessant guerilla warfare upon his defenseless rights have unquestionably amounted to millions."

Horace H. Day seemed to be the outstanding trouble maker for Goodyear, and their controversy finally came to trial at Trenton, N. J., before Judge Robert C. Grier with Daniel Webster defending Goodyear and Rufus Choate representing Day. Choate tried to prove that Goodyear was not the inventor; that his patent of 1844 had been abandoned; that Hancock was the inventor; and so on and so forth. Webster, then 71 years old, delivered his $25,000 oration, the highest fee ever paid an American attorney up to that time. Webster won the case on a decision handed down September 28, 1852.

Goodyear then went to England and at a cost of $30,000 of borrowed money produced the Crystal Palace exhibit. Then in 1854 he went to Paris where at the International Exposition he attempted to outdo his London exhibit. Here he spent $50,000 of borrowed money. Because he was unable to repay this, he was placed in jail in Paris, but while in prison Napoleon III awarded to Goodyear the Grand Medal of Honor and the Cross of the Legion of Honor.

In December of 1855 he left France for England and was arrested again on French demands. His health was bad, and he finally returned to America in 1858. He bought a home in Washington and decided to retire, although he fixed up a room in which he might experiment with rubber.

In 1860 he learned of the illness of his daughter in New Haven. He started out to see her, taking a boat for New York. He was met by his son-in-law who informed him of his daughter's death the day before. He was taken to a hotel on Fifth Avenue where he died the next day, July 1, 1860.

Briefly this is the life story of the man we now honor one hundred years after his invention. Certainly no one who knows this story would say that he discovered the process by accident. He possessed the true spirit of research and a passion to solve this particular problem. He once said "It may . . . be considered as one of those cases where the leading of the Creator providentially aids his creatures by which are termed accidents, to attain those things which are not attainable by the powers of reasoning he has conferred on them."

Few characters in history could be cited who possessed such steadfastness of purpose, such devotion to an idea. He was a Christian man and on many occasions could he too have exclaimed, "Father forgive them for they know not what they do." His life stands as a challenge for our youth to study and emulate.

Goodyear on His Discovery[1]

". . . The success of the inventor, in imparting to gum-elastic new and valuable properties, and at the same time retaining all the useful qualities it possessed before, has not ceased to be matter of surprise to mankind, wherever it has become known.

"This substance, aside from the difficulty of managing it chemically, was in its native state as wonderful and mysterious as any in nature, and it is rendered yet more wonderful, by the change wrought in it by this discovery.

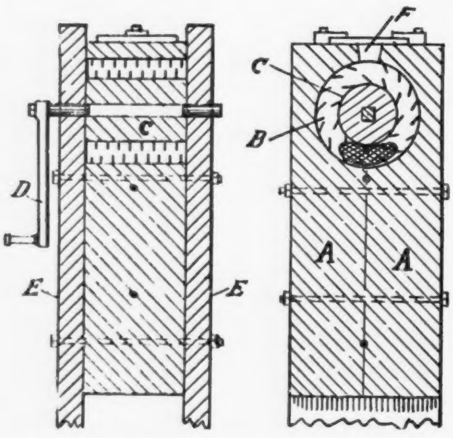
". . . It will be readily perceived, that the effect of this process is not simply the improvement of a substance; but it amounts, in fact, to the production of a *new material.* The durability imparted to gum-elastic by the heating or vulcanizing process, not only improves it for its own peculiar and legitimate uses, but also renders it a fit substitute for a variety of other substances where its use had not before been contemplated.

". . . It is impossible to set bounds to its application . . ."

[1] "Gum-Elastic." by Charles Goodyear. 1855. Vol. I, pp. 131-33.

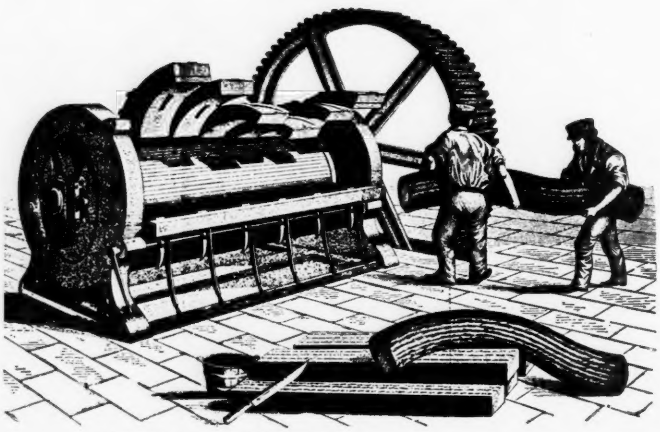
The Development of Basic Rubber Processing Machinery

S. C. Stillwagon



Pearson's "Rubber Machinery"

The Hancock Original Masticator



Hancock's "Personal Narrative"

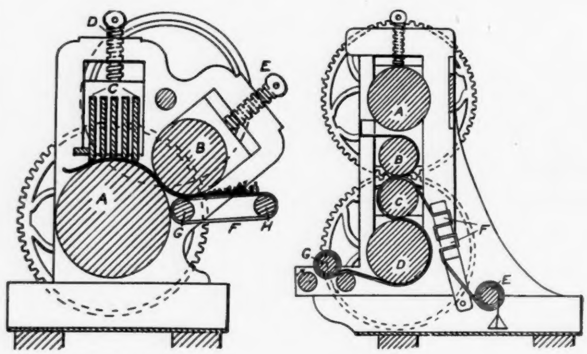
The Hancock "Mammoth" Masticator

THE successful transformation of rubber into the thousands of different products manufactured today depends to a large extent upon the mechanical means available. The foundation of the highly efficient modern rubber industry was laid many years ago, and it is significant to point out that much of the equipment used in processing rubber now does not differ essentially from the machinery originally introduced to the rubber factory. Refinements in design and construction have been many, but basic principles of operation remain practically the same. In this article the early history of rubber machinery will be traced. The discussion will be limited chiefly to some of the more important machines: the masticator or internal mixer; the mill; the calender; the extruder; and the press. The pictorial treatment will stress conditions of half a century ago when INDIA RUBBER WORLD was founded.

The Internal Mixer

This year marks the centennial of the greatest single event in the history of rubber, the discovery of vulcanization by Charles Goodyear. However there was another event of paramount importance in building the foundation of the modern rubber industry. This was the discovery of "mastication" by Thomas Hancock in England during the Summer of 1820. His first "masticator," the earliest known machine used in any type of rubber manufacture, consisted of a spiked roll working inside of a spiked hollow cylinder of wood; the roll which was attached to a crank handle was driven by hand power. Before the advent of this machine no means were available to break down the elastic nerve of rubber so that it would be amenable to processing. The machine was not patented; yet Hancock managed to keep it secret for 12 or 13 years. For deception Hancock called his machine the "pickle."

The importance that Hancock attached to his discovery is indicated in his own words:[1] "I wish here to remark that the discovery of this process was unquestionably the origin and commencement of the India-rubber manufacture, properly so called: nothing that had been done before had amounted to a manufacture of this substance, but consisted merely in experimental attempts to dissolve it; and even this had never yet been affected for any useful purposes."



Pearson's "Rubber Machinery"

***(Left)*, The Chaffee Mixer Showing Rolls A and B, Rubber Feed Belt F, and Ingredient Feed Bars C; *(Right)*, The Chaffee Friction Calender *(Monster)* with Cloth Passing from Right to Left**

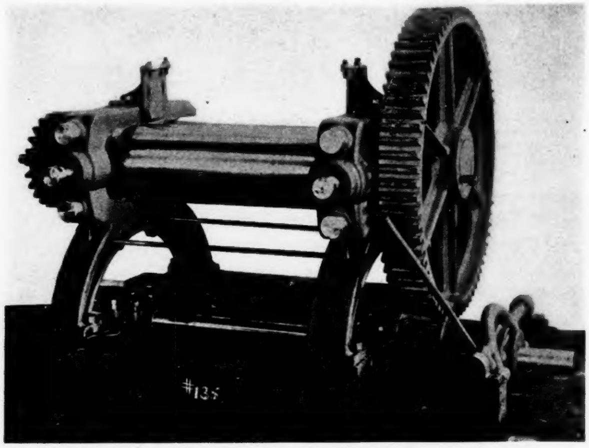
Hancock's first machine which would accommodate only two ounces of rubber was displaced by his larger machines of essentially the same construction except that the spikes were removed and iron was used instead of wood. A large masticator was eventually built that would take a charge of 200 pounds of rubber. This kneading engine, as it was called, installed in the Macintosh factory in England in the neighborhood of 1840, was five or six feet high by eight to ten feet in length and consisted of a powerful cast-iron box or chest with six heavy iron lids. Within the chest and along its horizontal axis was a mas-

[1] Thomas Hancock, "Personal Narrative," p. 13, London, 1857.

sive roller of cast-iron with fluted edges, which was connected to an engine shaft through a gear system. The rubber was placed in the box; the lids bolted down, and the roller set in action. After an hour or so of mixing, the machine was stopped, and the lids were opened. The machine was again started, and the plastic rolls of rubber would discharge into the arms of the workmen.

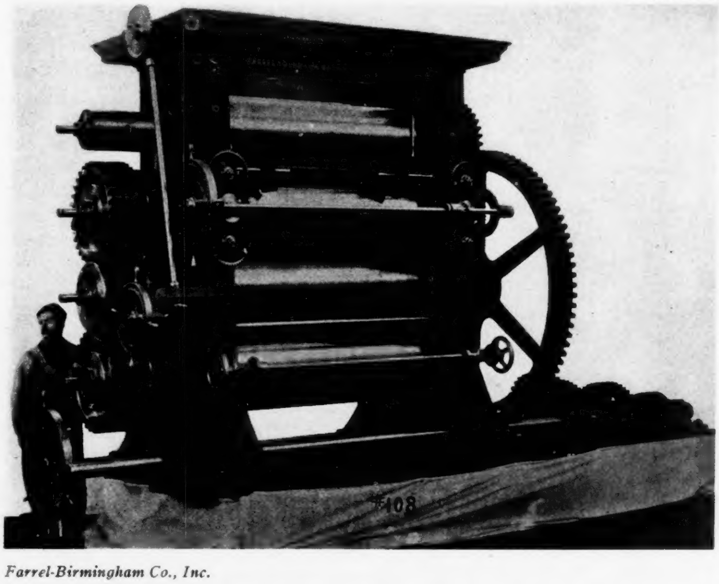
The only other known reference prior to 1835 to a machine that may have been used for masticating crude rubber is in a United States patent granted to J. J. Howe in 1820 for a mill, "constructed with a rolling and slipping motion, which forms India rubber for use on cloth or otherwise."

The internal mixer was improved upon and became popular in Europe. In this country, however, mastication was carried out on the two-roll mill and the internal mixer did not gain favor here until its design was revolutionized by F. H. Banbury in 1916. The popularity of the Banbury mixer today is well established and, since its advent in 1916, it has become increasingly important in improving the efficiency of rubber goods manufacture.



Farrel-Birmingham Co., Inc.

Mill (16- by 40-Inch) Typical of Those Used in 1889



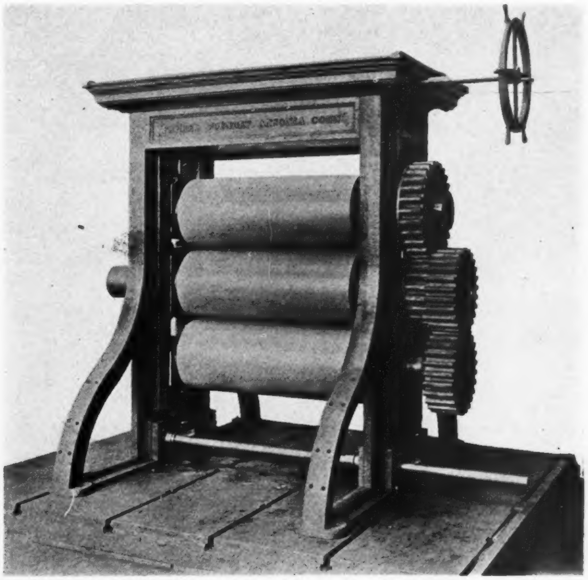
Farrel-Birmingham Co., Inc.

Four-Roll Calender of 50 Years Ago with Cornice-Top Housing

The Mill and the Calender

The mill and the calender were both patented in 1836 by Edwin M. Chaffee, who was at that time connected with the Roxbury India Rubber Factory, Roxbury, Mass. Chaffee's patent claimed a new and useful improvement: (1) in the application of undissolved caoutchouc to cloths, leather, and other articles; (2) in coloring the same without the aid of a solvent; and (3) in the machinery used in the process. The invention was mainly for a preparing machine (two-roll mill) and for a coating and covering machine (calender).

The preparing machine, according to his patent, consisted of a hollow cylinder or roller, six feet long and 27 inches in diameter, adjacent to another cylinder of the same length, but of only 18 inches diameter, both heated by steam, or otherwise, to about 200° F. The parallel rolls came in contact at a point about 10 inches distant from the top of the larger roll, and, as one turned faster than the other, there was a rolling and slipping action which softened and tore the rubber. The rolls were placed neither horizontally nor vertically in relation to each other, but in an angular plane.



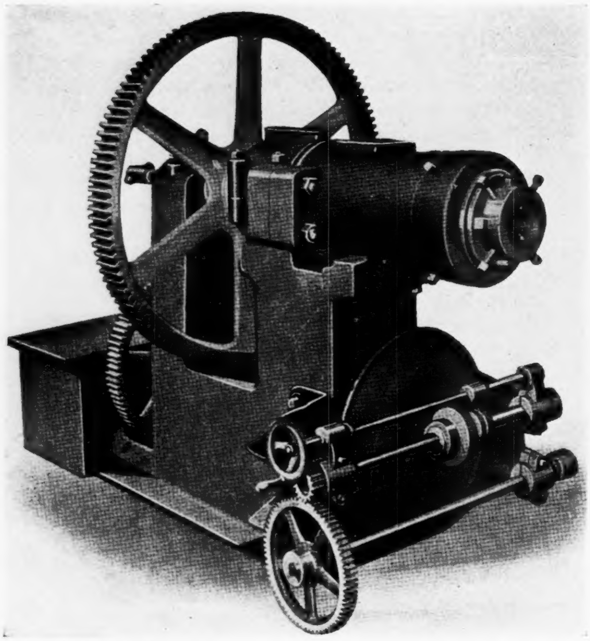
Farrel-Birmingham Co., Inc.

Three-Roll Calendar (18- by 48-inch) Built in 1857, Rebuilt in 1916, and Used for Army Raincoat Fabric during the Civil and the World Wars

The coating or covering machine consisted of four hollow rolls or cylinders placed one above the other, each six feet long and capable of being heated to about 200° F. The bottom and top cylinders were 18 inches in diameter; while the two inside ones were only 12 inches in diameter. This coating machine was called the "Monster" or the "Mammoth" because of its dimensions. It weighed about 30 tons and was completed toward the end of the year 1836 at a cost of $30,000. The Roxbury India Rubber Factory purchased from Chaffee his entire interest in the "Monster," and during October, 1843, the machine was sold at public auction for only $525 to John Haskins,

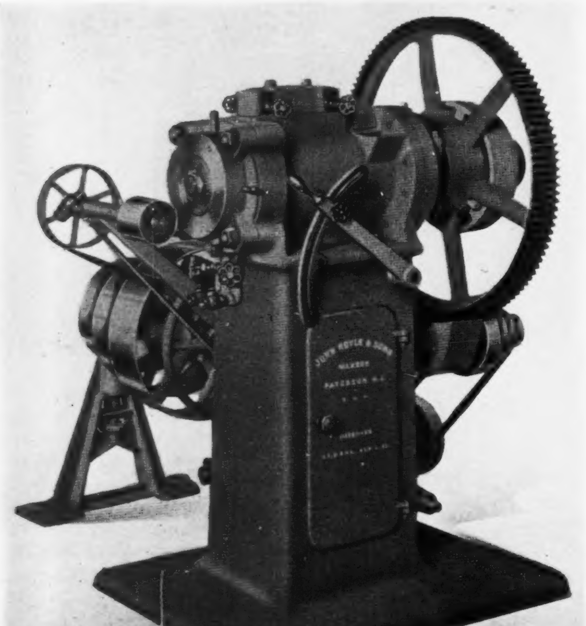
John Royle & Sons

Rear View of Bell Base Tubing Machine—1880



Adamson Machine Co.

Tubing Machine—1905



John Royle & Sons

Spur Gear Tuber—1894

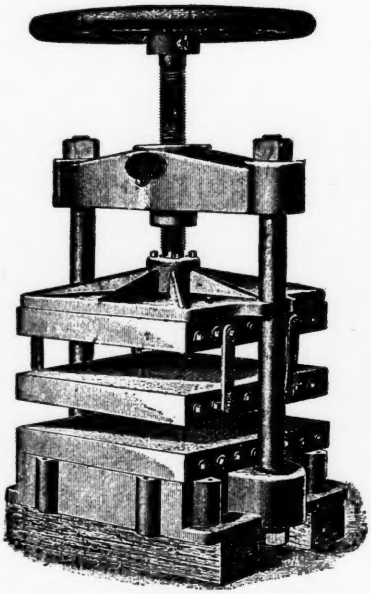
who, at the same time, purchased the patent for $1.50. During the year following, 1844, Haskins disposed of the "Monster" to Charles Goodyear, who, shortly afterward, transferred it to the Naugatuck India Rubber Co.

Following Chaffee's machine the early mills, or grinders, as they were more appropriately called, made a horrible clatter with their many gears and an ear splitting noise from shrieking belts. The belt-driven pulley shaft was provided with a large gear that ran into a pinion set near the floor. This pinion was on a shaft that ran across the back of the mill and at its extreme end held another pinion which in turn engaged with the large gear that turned the front roll. A similar shaft ran in front of the grinder and, taking its power from the driving gear of the front roll by means of its pinion, turned the back roll. Thus the power went entirely around the grinder to the two mill rolls. This "boomerang" pattern, with endless modifications, continued to do its work for many years. These mills were small, slow-running machines and mixed batches of 12 to 14 pounds.

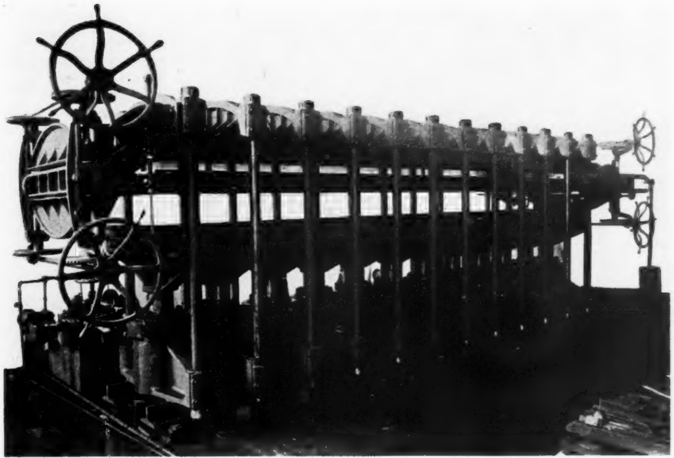
In the very early days chilled iron rolls for mills and calenders had to be imported from England. In America, Birmingham Iron Foundry was one of the earliest manufacturers of chilled iron rolls, starting early in the 1850's and followed shortly in the same decade by Farrel Foundry & Machine Co.

Prior to 1889 the mills in common use were of a small size. The most common size was 16 by 40 inches, and the first departure from the use of small mills was about 1890 when Farrel built a 20- by 60-inch mill for The B. F. Goodrich Co. In 1897, 24- by 84-inch mills came into use; the first ones were made for the Hartford Rubber Works. Mixing aprons were first introduced in 1893 by Edward F. Bragg.

The early mills were line-shaft driven and had rough cast tooth gears which were unguarded. There was no safety device, and the only method of stopping the mill was to throw out a clutch and let it coast to a stop. The mills of today retain their original form, with the principal change being in their refinement of design with greater weight and strength to handle the heavier batches and higher speeds. Other improvements include more effective cooling, cut gearing for smoother and quieter operation, gears enclosed in guards with provision for running them in oil, self-adjusting guides, and safety devices for quick stopping. Modern mills are also driven in smaller groups or individually by electric motor drive in-



Hand-Wheel Press of 50 Years Ago



Farrel-Birmingham Co., Inc.

Early-Type Hydraulic Belt Press with Hand-Operated Clamps and Stretching Device

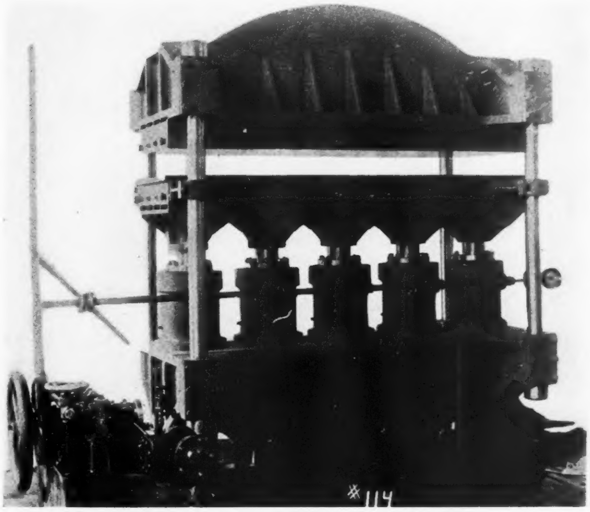
stead of having a large number on a long line shaft driven by engine or water power as was the case 50 years ago and earlier.

A peculiarity of the early calenders was the cornice top housings. It is said that the early engineers were originally pattern makers, and cornice top housings are believed to be the results of their experience in making wood forms. As in the case of the mills, the calenders had the cast tooth open gearing. They were usually driven from the mill line shaft either at the end of the line or through a bevel gear driven cross shaft at right angles to the mill line. A friction clutch allowed the frequent starting and stopping when the calender was "threaded." Present-day calenders have a much heavier box-type housing with arched top and with greater stiffness and strength and more pleasing appearance. Individual drive by variable speed direct current motor is common practice today. Adjustment of the top and bottom rolls on modern calenders is through a single hand-wheel or electric motor.

The Tubing Machine

One of the first applications of the extrusion principle by a rubber man was in 1846 when Charles Hancock plasticized gutta percha by forcing it through holes in the bottom of a cylinder screw press, kept hot by a steam jacket. In 1848 Hancock insulated continuous lengths of wire by the use of a combination die box and a cylinder with a piston. An interesting tubing machine which preceded the common screw-type design was invented by John Robertson[2] in 1868. This tuber (illustrated on page 56 of this issue) was of the extrusion type, utilizing two parallel acting rams for forcing the rubber through the die. The action was intermittent rather than continuous because the cylinders had to be reloaded after each stroke.

The origin of the tubing machine of the modern screw-acting type is open to some question. In a letter to INDIA RUBBER WORLD[3] a William Kiel indicated that he designed and introduced the first tubing machine of the screw-forcing type.



Farrel-Birmingham Co., Inc.

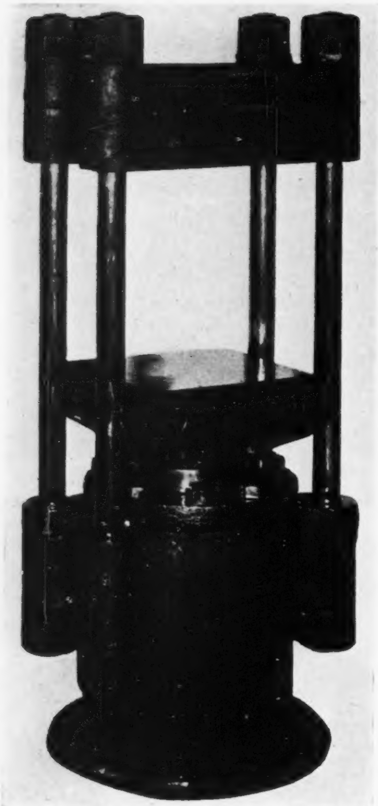
Early Hydraulic Press (36- by 124-Inch) with Individual Pumping Unit (Tie Rods for Corners Only and Small Diameter Rams Indicate Low Pressure)

Said Mr. Kiel, ". . . when I was first engaged in the establishment of the Rubber Comb & Jewelry Co.'s factory [later combined with other firms to form the present American Hard Rubber Co.] in 1876, I had a rod and tubing machine constructed according to my own idea, which machine and duplicates thereof have been in use ever since. . . ."

This claim was disputed by E. A. Cabona[4] who gave credit for the first tuber to a John Prior who began work at the Brooklyn Color Works in August, 1876. Mr. Cabona also held that the idea of the machine was developed from the machine that makes lead pipe rather than the macaroni press, as was believed by many men in the rubber industry. An early proprietor[5] (1890) of the Tubal Cain Iron Works of Brooklyn, N. Y., also claimed to be the first builder of a tubing machine in this country. He used a horizontal screw to force the rubber through the die. The first British made machine of this type was said to have been developed by Francis Shaw[6] in 1878-1879, while in the employ of Chas. Macintosh & Co.

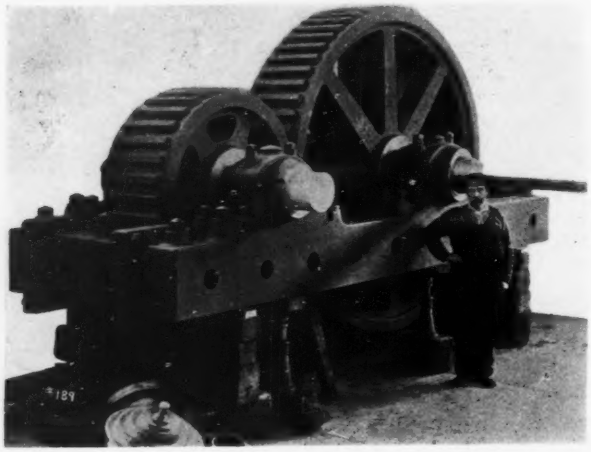
Prominent pioneers and leaders in the development of

[2] U. S. patent No. 76,649.
[3] Jan., 1919, p. 191.
[4] INDIA RUBBER WORLD, May, 1919, p. 432.
[5] *Ibid.*, Feb., 1890, p. 98.
[6] *India Rubber J.*, July 28, 1918, p. 8.



Adamson Machine Co.

Hydraulic Press—1905



Farrel-Birmingham Co., Inc.

Engine Drive for Single Mill Line; This Type Continued in Use until the Introduction of Motor Drives

the screw-type tubing machine were John Royle and his two sons, John and Vernon. The younger and elder John were machinists; while Vernon acted as draftsman, salesman, and office clerk. Vernon, later and until his death recently, was a leader in developing and perfecting the extruding machine. Royle's first tuber was built in 1880 and sold to the New York Belting & Packing Co., of Acquakanock (now Passaic), N. J. A branch factory of this same concern bought the second Royle machine. Competition came fairly early in the history of the Royle company. A machine was sold by Royle to a Mr. Gray, a rubber manufacturer of Hartford, Conn. Mr. Clark in Gray's employ copied the machine, and presently it was offered as the Clark tubing machine. After Mr. Clark's death, his tubing machine business was absorbed by Royle.

When the first tubers were manufactured, operating speeds of ten or twelve turns per minute were considered to be satisfactory. Stock screws and gears were made of cast iron. The first thrust bearing was merely a steel screw with a hardened point which bore against a depression in the butt end of the stock screw. After the tubing machine found general acceptance by the rubber industry, steps were taken to improve the design, maintaining the same essential principles of operation. Development during the past half century has been devoted chiefly to increasing the size and to general refinement. The first 12-inch and 14-inch tubers were built by the Adamson Machine Co., which was incorporated in 1909 as an outgrowth of a business established in 1892 by Alexander Adamson, largely for the purpose of repairing rubber and farm equipment.

The Hydraulic Press

The development of the hydraulic press was recently discussed by F. G. Schranz.[7] The hydraulic principle, discovered by Pascal in 1650, was not successfully applied to presses until 1795 when Joseph Bramah, an Englishman, invented the first hydraulic press. The first Bramah presses were built in capacities up to 300 tons with a working pressure up to 1,200 pounds per square inch. Operation of these early presses was slow; hand pumps and later power-driven pumps were used to transmit the hydraulic power. In 1840 Armstrong invented the hydraulic accumulator, the next major step in press development. The modern self-contained hydraulic press was made possible by the invention of the rotary piston type pump by Hele Shaw, of London, England, in 1914. With the introduction of this pump came the use of oil as the hydraulic medium. A more recent development is the hydro-pneumatic accumulator in which the hydraulic pressure is maintained by high-pressure air compressors and the water is replenished by high-pressure pumps.

Although hand-operated presses with bevel gearing were used extensively in the early days of the rubber industry, the hydraulic press was also ultilized at an early date. Before 1850 the Macintosh factory in England was using hydraulic presses in manufacturing rubber blocks which were then cut into sheets. Cast-iron molds, six feet long, one foot wide, six inches thick, were filled with masticated rubber, placed in a hydraulic press, and kept there until the rubber was cold. Thomas Hancock patented in 1846 the use of molds and the process of forcing the rubber into the molds by pressure and heat, and then vulcanizing.

The general appearance of presses has not been changed materially during the many years of development. Fifty years ago they were of light construction and usually were built with a platen pressure not exceeding 100 pounds per square inch. Since that time design and construction have been modified so that pressures of many thousands of pounds are now available.

Power and Its Transmission

A water wheel, believed to be the first ever used for transmitting power for the manufacture of rubber, was installed in the Goodyear Metallic Rubber Shoe Co.'s

(*Continued on page 62*)

[7] "Press Development." *Baldwin-Southwark*, Third Quarter, 1939, pp. 14-18.

Nineteenth Century Patent Models Relating to Rubber

Kimball Houton Stark [1]

ALTHOUGH the American Colonies were mainly agricultural, there was from the beginning a gradual growth of industrial development. In order to protect and foster such progress individual inventors were granted rights of monopoly and patent grants by the individual colonies and states.

The first patent act passed by the Federal Government of the United States was enacted April 10, 1790. Members of the first Patent Board or Patent Commission who officially called themselves "Commissioners for the promotion of useful arts" were Thomas Jefferson, Secretary of State; Henry Knox, Secretary of War; and Edmund Randolph, Attorney General. Thomas Jefferson may be considered to have been the first "Patent Commissioner" because of the responsibility of his department and because technical and scientific matters were particularly appealing to him, and he was also an inventor of considerable merit, his inventions including a Mold Board for the Plow and a Revolving Chair.

One of the provisions of the Patent Act of 1790 was that the inventor shall furnish a working model of his invention to the Patent Office. This stipulation remained in effect until the year 1880 at which time it was annulled, specifications and drawings only being thereafter required. From 1790 to 1836 some 10,032 patents were granted and issued without having patent numbers assigned. From 1836 to and including 1880, an additional 236,136 patents in numerical sequence were granted. Accordingly, a total of 246,144 patents were issued in this 90-year period.

A special commission was appointed by Act of Congress in 1925 to dispose of patent models. All the patent models which were sold by the government were purchased by Sir Henry Wellcome, the famous English collector, and after his death in 1936 the entire collection became the property of the American Patent Models, Inc.

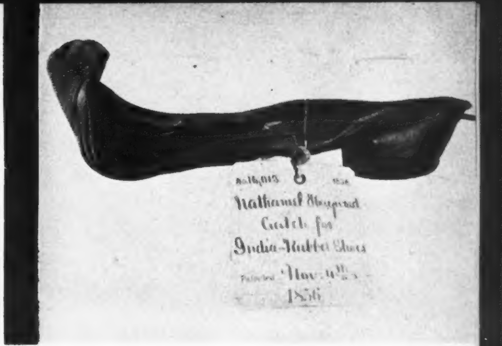
The collection was packed in 3,251 packing cases, and from the approximately 25,000 patent models now unpacked the models herein pictured were chosen as illustrative of the progression of rubber technology and its applications during the nineteenth century. Although many of the models made from rubber show evidence of considerable deterioration, a number of them are in excellent condition with the rubber still flexible and uncracked. Molded impressions on many of the models indicate some of the early rubber manufacturers.

It is believed that such models are not only intensely interesting from an antique and historical point of view, but that a study of such models relating to a given industry and the specifications of the invention will in many cases be most valuable from a technological point of view even in terms of our present-day engineering achievements. Certainly, the first requisite of twentieth century research is the utilization of as complete a bibliography concerning the subject at issue as it may be possible to compile, and, when such bibliographical knowledge including both patent and publication prior art, may be enhanced by visual examination of the patent models concerned, the absolute minimum of questionable knowledge can remain unknown to the research worker.

It is in that spirit that American Patent Models, Inc., is most pleased to have this pictorial and descriptive review of nineteenth century patent models relating to rubber appear in this Golden Jubilee Issue of INDIA RUBBER WORLD and to have had these same and additional models on display between September 11 and 17 at the fall meeting of the American Chemical Society at Boston, at which time all chemists honored Charles Goodyear for his discovery of vulcanization 100 years ago.

The American Patent Models, Inc., is also pleased to invite all chemists, engineers, and scientists to view its private exhibit of some 25,000 patent models at its exhibit room at 630 Fifth Ave., New York, N. Y.

[1] Director of research, American Patent Models, Inc., 630 Fifth Ave., New York, N. Y.



16,013 (1856). Nathaniel Hayward, co-worker of Charles Goodyear, invented a catch for rubber shoes which retains the overshoe in place on the foot and makes it possible, by pressing with the foot upon the catch, to remove the shoes without using the hands.

18,583 (1857). The inventor claims the use of a cast heel of rubber together with an entire shoe sole of rolled or sheet rubber. The impression on the model heel mentions the Hayward Rubber Co. and Hayward's patent heel of 1854.

74,168 (1868). A life preserving rubber suit has openings for the head and hands only, elastic bands rendering them watertight. A cork jacket, covered with rubberized cloth, is worn around the chest; folding paddles are fixed to the hands; and weights are worn on the feet.

35,115 (1862). The roller cores of this clothes wringer have fluted surfaces. Hollow rubber tubes are fitted into the flutes, and then a larger rubber tube is forced over the entire assembly.

25,749 (1859). In this method of forming joints in double flat rubber belting a tongue is inserted in a cut-out cavity; the interleaved joint is then securely sewed together.

19,269 (1858). Thomas C. Wales manufactured waterproof gaiter shoes and boots by using a combination of fabric, leather, and vulcanized rubber. The insert shows the trademark of The Goodyear Metallic Rubber Shoe Co., Naugatuck, Conn., and indicates that the model was manufactured under a patent granted in 1844 which is undoubtedly the original vulcanization patent of Charles Goodyear. The Naugatuck firm was the first licensed.

13,272 (1855). Metallic heel rims include recesses in which rubber is placed; then the rubber and the heel rims are permanently locked together, by pressure and vulcanization.

116,439 (1871). This heel or sole tap consists of an outer sole of sheet rubber and an inner sole of rubberized fabric between which is placed a perforated metal plate; the inner and outer soles are bonded through the perforations of the metal plate according to this invention.

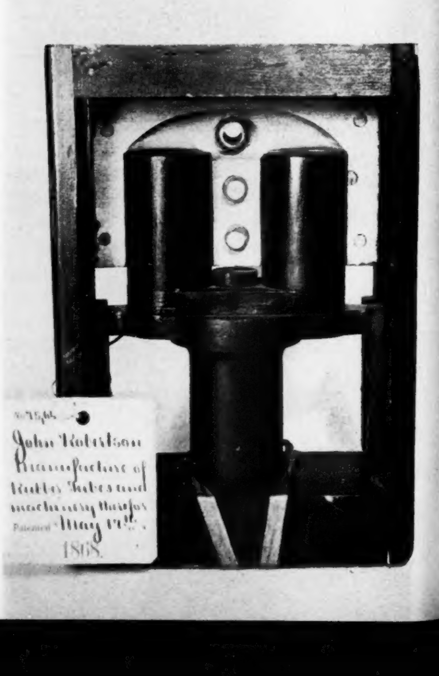
56,992 (1866). A rubber strip is placed within a hollow boot heel made of metal; the movable bottom of the heel is arranged so that the rubber strip provides elasticity.

34,142 (1862). In uniting a rubber roller with a metal shaft, a coating of copal varnish and a layer of twine are first applied to the shaft, and then one or more coatings of rubber cement are applied to both the shaft and the bore of the tube before the roller is forced upon the shaft.

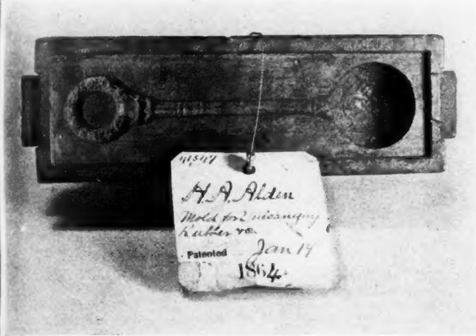
33,464 (1861). A bath of wax, or equivalent substance, is employed as the medium for applying vulcanizing heat to rubber compounds. The patent was assigned to the American Hard Rubber Co., New York, by the inventor.

36,480 (1862). For the purpose of protecting the iron shaft of this early wringer roller from the corrosive action of the sulphur contained in the vulcanized rubber, a casting of an alloy of metal is interposed between the iron shaft and the rubber roller covering before assembly.

75,649 (1868). This invention of John Robertson, of Brooklyn, N. Y., provides for the manufacture of rubber tubes. An inner metal core passes out with the rubber tube to prevent its collapsing as the plastic rubber is forced through the die by the two parallel rams.



72,073 (1867). A two-section boot and shoe heel is made of rubber; the bottom section is removable and rotatable to provide fresh wearing surfaces. Attachment of the two-heel section is provided by a cylindrical projection in the heel bottom which fits into a circular recess in the upper section.



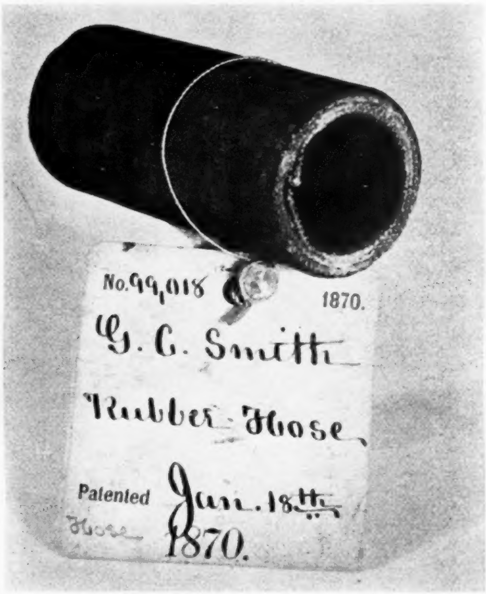
41,347 (1864). A cast-iron mold for vulcanizing rubber is lined with type metal or other comparatively soft and fusible metals. The invention was assigned to the New York Rubber Co.

77,717 (1868). Warmth and ventilation in a rubber shoe are obtained by a single lining fabric having a rough or woolly side placed next to the upper, and a smooth side placed toward the foot. The impression on the heel mentions the Boston Rubber Shoe Co. and D. Hayward's patent of 1854.

84,369 (1868). Gutta percha or rubber is combined with clay, iodine, and wolfram or tungsten oxide, an early example of the attempt to improve the properties of rubber through compounding.

96,412 (1869). Leather soles are attached to rubber boots and shoes, the soles made to adhere by vulcanization. The impression on the heel designates the Woonsocket Rubber Co.

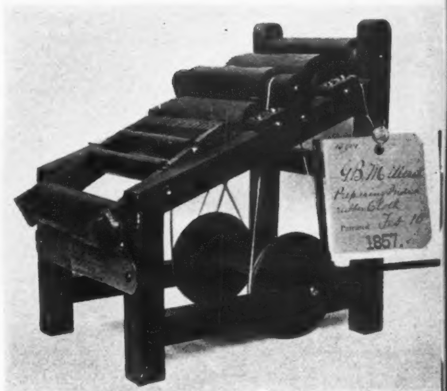
96,020 (1869). Irregular-shaped rubber goods with walls of uniform thickness are formed by placing a rubber blank upon a hollow canvas core filled with sand, wrapping the assembly with strips of canvas, and then curing.



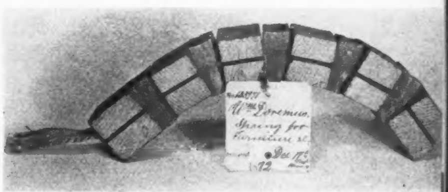
99,018 (1870). This patent for fabric-reenforced rubber hose assigned to the New York Rubber Co., includes an inner elastic lining extended beyond the body of the hose to provide for removable caps at the hose ends.

109,725 (1870). A machine to cut sheets of rubber includes revolving and fixed cutters and an endless band to feed the rubber against the rotating cutters; the patent was assigned to C. Ensign.

118,624 (1871). A deckel strap for paper machinery is provided with a groove on its "working side." The multi-ply fabric core is spliced before it is encased in rubber and vulcanized.



16,601 (1857). This machine buffs a sheet of vulcanized rubber and bonds the sheet to fabric, through the use of pressure rollers. The cloth is previously treated with a thin coating of an unvulcanizable solution of rubber.



133,971 (1872). A spring for furniture comprises blocks of rubber and wood; the assembly is held together by strap webbing.

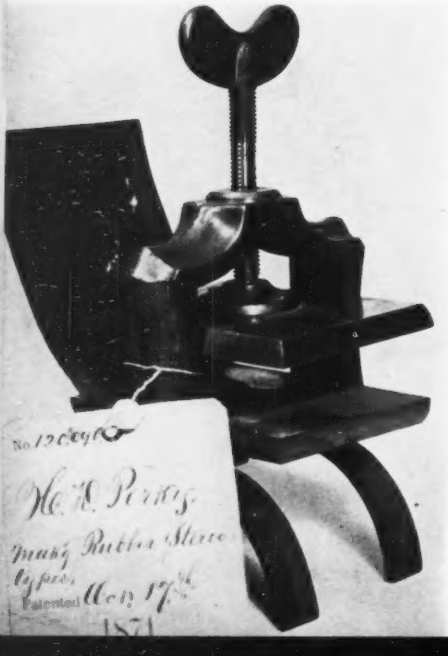
102,228 (1870). This ventilated rubber boot has channels between the lining and the outer rubber portion to allow circulation of air.

150,189 (1874). This invention combines a life-buoy and safe. The illustration shows the safe, a hollow collapsible rubber vessel in which one's valuables may be placed.

145,447 (1873). An endless driving belt is constructed of solid rubber balls strung on a flexible cord or wire according to this patent.

34,654 (1873). This suction hose comprises two metal spiral interlocking stiffeners, a sheath of vulcanized rubber, and an outer fabric covering.

120,096 (1871). With the application of pressure and heat, rubber printing forms are made in this press from vulcanizable compositions.



153,547 (1874). Cylindrical rubber blocks or cushions are used as a spring material, in this case as applied to a chair.

156,094 (1874). An ice creeper is molded of rubber and has a leather strip for attaching it to a shoe in the usual manner.

186,965 (1877). An early example of V-belting comprises a leather outer section encasing a body of rubberized fabric plies.

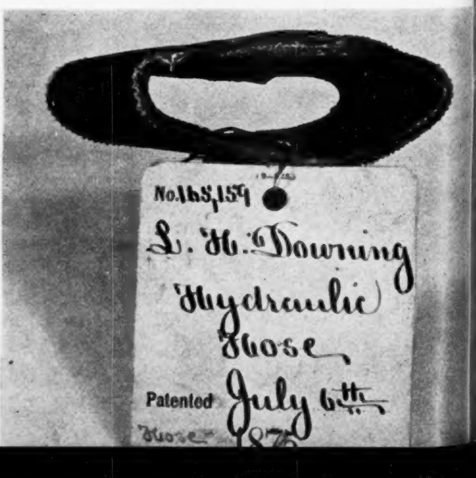
156,136 (1874). A boot or shoe heel and shank composed of wood or other suitable material is enclosed in vulcanized rubber.

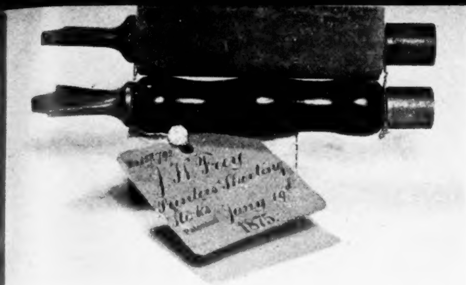
127,218 (1872). This air-tight fishing seine float is hollow and made of vulcanized rubber.

142,161 (1873). Daniel E. Hayward specifies the vulcanization of the lower surface of the sole of a shoe before applying it to the upper and then uniting the sole to the upper by vulcanization.

210,771 (1878). Rudolph Eikenmeyer, famous as an inventor in the hat industry, provides an elastic hat block of rubber with a metal insert for convenient handling when in use.

165,159 (1875). This hydraulic hose combines fabric covered with vulcanized rubber, the fabric being folded back and cemented at the lap joint to provide reenforcement.





158,792 (1875). This printer's "shooting stick", has a handle covered by a sheath of rubber so that the type will not be defaced.

194,350 (1877). This rubber plate is for printing on glass, porcelain, etc. The complete invention includes a machine designed especially for use with rubber printing plates.

196,147 (1877). This invention includes the preparation of rubber flooring so that its surface is free of foreign matter prior to painting and also the interposition of wire gauze or cloth between the rubber and the calender roller during processing.

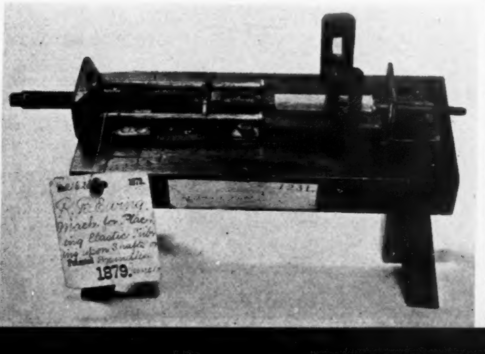
209,953 (1878). Flexible rubber hose has one or more seamless braided webs embedded in the rubber, the webs having laced filaments arranged obliquely to the length of the hose and with the direction of one laced web reversed with respect to the next.

217,728 (1879). A dental vulcanizer has a double-jacketed chamber combined with a screw press for holding the mold sections.

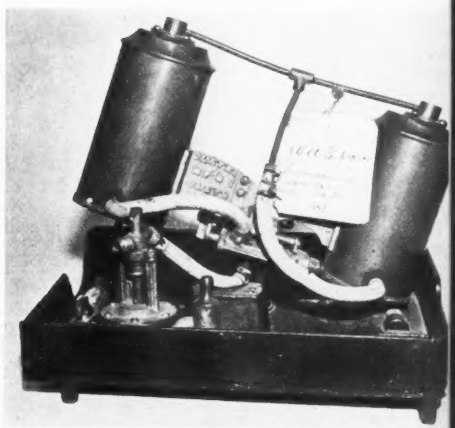
214,465 (1879). A dental air compressor operated by foot power uses a rubber compression bulb with rubber tubing to convey the air pressure to the tool in the dentist's hand.

219,327 (1879). A hinged metal form reenforces a molded rubber horsehose pad.

216,263 (1879). This machine for placing elastic tubing upon shafts or spindles utilizes a screw-operated tapered mandrel.



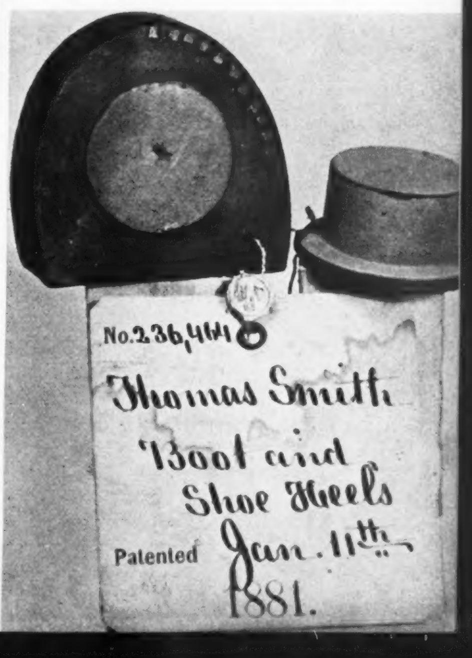
270,161 (1883). A rubber roller bearing shaft loop is used for harnesses.



253,830 (1882). This air compressor uses flexible rubber tubing under severe service conditions.

543,583 (1895). Multi-colored rubber tiles with exact color outlines are made by first semi-vulcanizing the sheets of various colors, then cutting out small pieces of these sheets, laying them side to side, interposing between them unvulcanized films or strips of rubber, and then completely vulcanizing the entire tile.

236,464 (1880). A cylindrical rubber heel is in serted in an ordinary leather shoe heel.



Compounding in the Nineteenth Century

Webster Norris

DURING most of the eighteenth century practically no interest was taken in rubber. Toward the close of this period attempts to utilize it began in earnest but, during this period and the early nineteenth century, trials were confined to softening the gum in oils and other solvents so as to produce a spreadable mixture for waterproofing fabrics. Dry powders were incorporated in the mix or were used as a surfacing treatment to eliminate stickiness of the material. However after years of futile effort to solve this rubber working problem the resources of many experimenters were exhausted. Failure to produce useful and merchantable goods was due to the fact that the natural characteristics of the crude were not modified. Consequently the products became unmanageably stiff in winter, while the heat of summer converted them into a sticky mess. The first successful rubber mixing and processing was revealed when Goodyear made his momentous discovery in 1839, and vulcanization was realized.

In the record[1] of his discovery Charles Goodyear, referring to the early misdirected experiments and the nature of his discovery, wrote as follows:[2]

"As early as the year 1800 whenever the properties of India rubber became known and appreciated, it became a subject of much inquiry and experiment to ascertain if there was any way by which it could be dissolved and afterwards restored to its original state. It was not thought of nor expected (certainly not by the writer) materially to improve upon the original good qualities of the gum."

Two years passed before the merit of Goodyear's discovery was generally conceded to be the long-sought means of changing crude rubber into the stable and improved state in which it could be adapted to useful purposes.

Observations by Charles Goodyear

The rubber mixture specified by Goodyear in his patent on vulcanization consisted of "One pound gum elastic, one quarter to half pound of sulphur and half to one pound of white lead." Exposure to heat for curing was indicated at "about 270°"; however, the duration of the necessary heating was not given.

Regarding the accomplishments of vulcanization and the effect of heat on rubber, Goodyear said:[3]

"An article is obtained which is not dissolved without great difficulty, by the best known solvents of gum-elastic, which yet possesses all the valuable properties of the native gum, and many others that the native gum does not possess. It will be readily perceived that the effect of this process is not simply the improvement of a substance but it amounts, in fact, to the production of a new material. The durability imparted to gum-elastic by the heating or vulcanizing process, not only improves it for its own peculiar and legitimate uses, but also renders it a fit substitute for a variety of other substances where its use had not before been contemplated. . . .

"A distinctive and singular feature in this discovery, and one that is deserving of special notice, is this, that heat, which is one of the two principal agents which produce the desired result, melts every kind of caoutchouc at a comparatively very low temperature. The heat of the sun's rays will melt them, while, with the presence of the other agent, that of sulphur, the great change is wrought in the caoutchouc, and the improvement is completed, at the high temperature of nearly 300°."

Although very little practical compounding had been done a century ago, it is of interest to note the extent of Goodyear's knowledge as is evidenced by the following from his own written observations:[4]

"It is important to observe, first of all, that the sulphur, lead or other articles that are compounded with the gum, should be pure, and free from acid, otherwise the gases that are generated in heating will cause the gum to blister; and when these substances, however pure, are compounded with dissolved gum, and especially with liquid cement, it should be used soon after it is mixed, and when the weather is very warm, or when it is kept in a warm room, within a day or two, otherwise it will

Webster Norris, S.B. (M.I.T.)

WEBSTER NORRIS became associated with rubber on July 18, 1887, when as chemist he equipped a laboratory at the Boston Rubber Shoe Co., Malden, Mass. It is believed that this concern was the first rubber company regularly to employ a chemist on its factory staff.

In 1895 Mr. Norris transferred his activities to the mechanical rubber goods line as chemist for the Revere Rubber Co., Chelsea, Mass., and for 22 years was connected in chemical and superintending capacities with various rubber companies including The Gutta Percha & Rubber Mfg. Co., New York, N. Y.; The Canadian Rubber Co., Ltd., Montreal, P. Q., Canada; The Republic Rubber Co., Youngstown, O., and the New York Rubber Co., New York, N. Y. From 1917 he conducted a private practice as consulting rubber technologist and was technical editor of the INDIA RUBBER WORLD until he retired in 1937.

[1] "Gum-Elastic." Charles Goodyear, 2 Vols., New Haven, 1855.
[2] *Ibid.*, Vol. I, p. 131.
[3] *Ibid.*, pp. 132, 134.
[4] *Ibid.*, pp. 154, 155.

ferment, and cannot be vulcanized. Ignorance of these particulars nearly prevented, for a considerable time, any practical applications of the discovery of vulcanizing being made by the inventor. Still greater caution is necessary when camphine or spirits of turpentine is used for dissolving the gum, for though it be obtained perfectly pure, yet if it is exposed to the atmosphere, or left to stand for a length of time, it becomes acid and unfit for dissolving gum-elastic. It was owing to this circumstance that the first goods manufactured in the United States were much worse, and the losses were much greater, than they otherwise would have been; and a want of proper care with regard to these various particulars, was the cause of many accidents, and much loss to those persons who first engaged in the manufacture of vulcanized gum-elastic, especially when dissolved gum was used.

"Gum-elastic can be readily mixed or combined with almost every other substance. It may be mixed with other gums, oils, coal-tar carbon, and with the earths and oxides, or pulverized metals and ores; and it can be combined with all fibrous substances, although it is not made like some of the gums, to adhere firmly to any smooth surface of metal or wood, or even to cloth. It is compounded in the manufacture with many of the above substances, for the purpose of obtaining particular advantages for special uses. Lampblack is often used to cause the gum to endure the effects of the sun and weather. Ground cork and other light substances are sometimes combined with gum, to increase the bulk and make the articles light.

"Earths are used as color, for cheapness and to increase the weight of the fabric, as in the case of carpeting. Bitumen and resin are sometimes used to give the articles a finish or high lustre. Oxides of some of the metals are used in the manufacture; among these, white lead, and litharge are commonly preferred. From two to four ounces of either of these metals to the pound of gum, cause the articles, and particularly those that are thick or massive, to be more readily changed, or vulcanized, and more completely, or with greater uniformity.

"In the process of vulcanizing, the sulphur is applied through the medium of heat, in different ways, for the manufacture of different articles or fabrics for different uses. It is sometimes mixed with the gum in the process of crushing or grinding the gum, in the proportion of half an ounce of sulphur to the pound of gum; at other times it is dusted upon the goods in the form of flour of sulphur, before the goods are placed in the heater, or oven; this is commonly done when the mixture contains white lead, or when the coat of gum is thin and the goods light, in which case the gum is more easily penetrated or impregnated with the sulphur, without its being mixed with the gum.

"Another mode of applying the sulphur or impregnating gum with it, is that of generating the sulphurous gas in the oven or heater which contains the goods, or of introducing it into the oven after it is generated."

Early Practice

For a number of years following the discovery of vulcanization, rubber compounding was relatively simple because the usage of rubber was very limited, being mostly for boots and shoes, weatherproof clothing, power transmission belting, water hose, pump valves, springs, and certain other mechanicals. Every rubber works superintendent was his own compounder and devised the mixings for all stocks required in his products. The list of compounding ingredients relied upon were principally sulphur, white lead, litharge, zinc oxide, lampblack, iron oxide, antimony sulphide, plaster of Paris, barytes, whiting, magnesia, lime, rosin, coal tar and palm oil. The prevailing color of rubber goods was gray or black.

Rubber mixing formulae were held secret and carefully guarded, but more or less important data were in constant circulation from plant to plant generally without much benefit to competitors because of technical differences in substitute ingredients and factory practices.

The following formula was printed by William H. Herbert in the *Mechanics Magazine* (1856), London.

ENGINE PACKING

	Pounds
Para rubber	25
Java rubber	5
Zinc oxide	16
Magnesia	6
China clay	3
Red lead	2
Sulphur	1⅞
	58⅞

This, and similar mixings, were regarded by Herbert as suitable for making high-quality mechanicals. From the viewpoint of the consumer he regarded much of the compounding of his day as cheap adulteration. He gave warning that specific gravity should not be disregarded and said that all rubber goods made with pure unadulterated rubber could be detected by their ability to float on water. Herbert added, "Any deviation from this is proof of some cheap stuff unfairly introduced." As a matter of fact, specific gravity is not a criterion of quality in the case of rubber goods of any type.

The following belt friction formula of unknown date or origin was used by a leading American mechanical rubber goods concern now non-existent, but which was incorporated in 1838 and reputed to have followed closely the Goodyear tradition of mixing.

BELT FRICTION

	Pounds
Coarse Para rubber	5
Assam rubber	7
Borneo rubber	10
Litharge	5
Zinc oxide	5
Whiting	5
Common rosin	0.75
Sulphur	2.50
	40.25

The already expanding list of compounding ingredients was notably enlarged by the introduction of reclaim produced by the Beverly Rubber Works, Beverly, Mass., under a patent issued to Hiram Hall, November 30, 1858. Steadily perfected by subsequent improvements, reclaim made possible great economy through its substitution in part for high cost crude rubber, and it greatly aided in extending the industry into certain lines where requirements were such that new gum could be reduced to a minimum and even entirely eliminated if need be. For many years reclaims have been available in numerous grades which later were standardized in the essentials of quality and technical merit of plant laboratory control.

Period of Expansion

The year 1870 marked the beginning of a trend toward more diversified application of rubber and the establishment of new companies to manufacture products quite largely for industrial consumption. The greater variety in the characteristics then demanded of rubber goods necessitated new formulae or, in frequent instances, modification of the old ones. This work was usually assumed by the factory superintendent who, in addition to his responsibility for plant operation and the quality of the product, was increasingly giving attention to costs. Pound cost was the prime factor in compounding. It was a

common practice to change the formula to lower the cost or for use as alternates for the regular ones in case of shortage of some component at the time of mixing.

New mixings sometimes contained proportions of other mixing as individual ingredients. This resulted in a needless complexity effectively eliminating control of quality and caused baffling freaks in the curing and aging of the goods. Very often the compounders, guided by rule of thumb experience, devised new stocks by the addition of ingredients to the gum on the mixing mill. The results were certain to be "hit or miss," and as a result many mill rooms were loaded with rejected stock which had to be disposed of at a loss. However workable stocks were the rule, and not infrequently outstanding successes were attained.

The formulae given below indicate the practice of American compounders in the manufacture of rubber boots and shoes fifty years ago.

SHOE UPPER (1889)

	Pounds
Fine para	8
Caucho ball	8
Litharge	5½
Whiting	20
Lampblack	1
Soft coal tar	4
Hard coal tar	3¾
Sulphur	9/16
	50 13/16

SHOE SOLING (1889)

	Pounds
Fine para	6
Caucho ball	10
Litharge	4½
Whiting	13
Lampblack	1
Soft coal tar	6
Shoe reclaim	5
Sulphur	9/16
	46 1/16

Pneumatic Tire Era

Rule of thumb compounding was set aside in favor of laboratory control of stocks when construction and quality for engineering goods were specified by the government and the railways and results were checked by engineers. Specifications for air-brake hose were first proposed in 1898. Rubber for tires began with its commercial application as "solids" on carriages in the "horse and buggy days"; then followed pneumatics on bicycles in the '90s and on automobiles near the turn of the century. At that point trade in plantation rubber started, and the study of crude rubber itself began.

Tire stocks of the present era, as is evidenced by actual service records, have been devised with outstanding physical properties which have yielded astounding tread mileage and have made possible equally remarkable tire carcass construction. These results represent the current art in tire construction made possible by the resources now available to the compounder as the result of research by manufacturers of rubber chemicals, specialized compounding ingredients, vulcanizing control apparatus, and rubber working machinery in conjunction with the efforts of the modern laboratories installed by rubber companies. Compounding as a division of rubber technology will continue to aid the expansion of the industry and will promote the utilization of latex and the synthetic rubber-like materials which now give great promise.

OF THE MANY ARTICLES USED IN COMPOUNDING INDIA rubber no other is so important as whiting. It has been said, indeed, that the chalk-hill is the rubber-man's best friend. INDIA RUBBER WORLD, *March*, 1890, *p.* 136.

Rubber Processing Machinery

(*Continued from page* 54)

plant in Naugatuck, Conn., shortly after Goodyear obtained his patent on vulcanization in 1844. For some time afterward nearly every rubber manufacturing concern used the water wheel as a power unit. Mortise gears were utilized to obtain the required reductions in some installations; in other instances where the speed of the water wheel was relatively slow, the wheel was directly connected to the line shaft.

The rubber industry grew rapidly and increased power sources were needed. Steam was being utilized in large amounts for vulcanization, and as a logical result the steam engine was adopted for power purposes.

Commenting on this, Goodyear[8] wrote, "There is, however, one advantage in favor of steam for this, which does not exist in some other manufactures, which is the use in it of steam extensively for other purposes besides the moving power, such as heating the callenders and grinders, vulcanizing and cleansing the goods, etc."

It is known that a steam engine was used in driving Hancock's masticator in 1836, over 100 years ago. At the beginning of the twentieth century and continuing for several years thereafter, the most favored power source was a low speed Corliss engine attached to the line shaft for driving washers, mills, refiners, and calenders. In many cases there were ten or more machines on one main shaft.

Electric power, universally utilized by the rubber industry of today, was introduced to the rubber factory before the turn of the present century. In Great Britain electrical power was said to have been first used by the rubber industry in 1888 when the Leyland & Birmingham Co. installed current in its factory. Motor drives in this country are known to have been installed in isolated cases as far back as 1894. The reduction in the cost of electric current, which came with the organization of electric power companies, led eventually to the general utilization of electric power. It was in the neighborhood of the year 1908 that the electric motor became well established in the rubber factory.

With the introduction of this new power source it became necessary to develop special gears. The year 1902 marked the introduction of the cut screw enclosed drives, and between 1909 and 1914 the next innovation in transmission took place—enclosed casings with built-in bearings; both gears and bearings were lubricated by a bath of oil. During this period the cut herringbone gear also came into use. Later developments were the Sykes gear in 1923 and the adaptation of anti-friction bearings for gear assemblies to heavy rubber machinery in 1930.

Machinery's Contribution

Although basic rubber processing machines have not changed fundamentally since they were originally introduced in the rubber factory, the improvements and refinements in design and construction which have been made through the years have materially benefited the industry. Utilizing modern engineering principles, machinery manufacturers have been able to adapt their machines to present-day efficient production methods. Aside from those basic machines generally necessary to rubber manufacture, many specialized machines have been developed as the requirements of the rubber industry grew. All of these mechanical developments have played a large part in the successful transformation of the rubber industry from one of largely hand method production into a highly mechanized and efficient industry.

[8] "Gum-Elastic." Vol. I, p. 150, 1855.

Vulcanization—
A Century After Goodyear's Discovery

A. R. Kemp[1]

IN 1834 rubber manufacture largely consisted of coating fabrics with softened crude rubber which was prepared from balls of "fine hard para." This industry was more or less a failure because the rubber became soft and sticky in summer and set to a board-like rigidity in winter. Becoming aware of this problem at that time, Charles Goodyear determined to devote all his energy toward its solution. For more than four years he carried out innumerable experiments trying to find some treatment which would make the rubber less sensitive toward temperature variations. Devoting to these experiments a very keen power of observation, Goodyear achieved final success early in 1839 when he noted that a mixture of rubber with sulphur and white lead charred and did not melt when heated to a high temperature, as rubber alone had always done.

Hayward had previously been coating fabrics with rubber and sulphur dissolved in turpentine and exposing them to the sun in order to dry up and toughen the surfaces. Although this treatment was only superficial, knowledge of it had undoubtedly led Goodyear to experiment with mixtures of rubber and sulphur. Following his first important observation early in 1839 many experiments in heating rubber compounds containing sulphur to high temperatures were carried out until he became certain that the rubber was changed to a state which was resistant to wide temperature changes. These experiments were continued during the next few years in order to obtain satisfactory commercial products. The mill and calender invented by Chaffee were already available and were found to be indispensable for mixing and sheeting the compounds. Thus was the stage set for the successful development of the rubber industry which went ahead rapidly.

Vulcanization was the term first chosen in England in 1842 by Brockendon to describe the change brought about by heating rubber and sulphur. Later, however, in 1846, Alexander Parkes found that heat was unnecessary when the rubber was treated with sulphur chloride. Although this method of cold vulcanization has been limited to the treatment of thin films of rubber and proofed goods, it has occupied an important position in the development of the rubber industry.

Not only was the vulcanization process successful in making rubber much less susceptible to temperature variations, but fortunate indeed it was that vulcanization had other very important influences. Vulcanization changes the soft plastic rubber to a strong highly elastic product with good recovery under a wide temperature range. In comparison with crude rubber, the tensile strength, stiffness, and the resistance to tearing and abrasion are greatly enhanced. The swelling in solvents is also greatly decreased.

Other substances besides sulphur and sulphur chloride were subsequently found to produce this change to a limited extent, but throughout the past century sulphur still remains the one essential substance required to produce the superior vulcanization effect. Sulphur vulcanization is also practiced in the case of the Buna rubbers introduced in recent years, and so it is that Goodyear's discovery has been extended into the field of synthetics.

The manufacture of ebonite (hard rubber) by heating rubber mixed with about one half its weight of sulphur also grew out of the discovery made by Charles Goodyear. In this case must be mentioned the work of Hancock in England, who noted the effect of heating rubber in molten sulphur, and of Nelson Goodyear, brother of Charles, who in 1851 patented the heating of mixtures of rubber and sulphur for long periods to form ebonite or vulcanite as it was then called.

Advance in the Art

Until recent years the materials and processes were not well understood or under proper control, and the quality of rubber goods was in consequence extremely variable. Some excellent rubber products, however, were made in those earlier years by experts in the field. For example, the author has examined rubber articles made more than forty years ago which are still serviceable even after use under outdoor conditions. In most of these cases the best quality wild Para rubber was employed with a moderate content of sulphur accelerated with litharge and compounded in well-balanced proportion with other suitable ingredients. Samples of rubber vulcanized with antimony sulphide also turned out to have excellent quality and long life, which led to a public demand for red rubber. For the most part, however, the quality of soft rubber suffered from the use of too much sulphur, poor control of vulcanization, and poor compounding practices resulting in manufactured goods which deteriorated quite rapidly and often were otherwise not suited for the service intended.

The most important advance in vulcanization after Goodyear's discovery was the introduction of organic accelerators, which was started in 1906 when George Oenslager discovered that aniline and other organic substances accelerate the vulcanization of rubber. These substances, now numbering hundreds of different organic compounds, when added in small amounts, greatly reduce the time of vulcanization, minimize the possibility of overcure, and improve the service life of the product. This development has been of inestimable value, and that this took place when the automobile industry was starting its phenomenal expansion was fortunate indeed.

Another very important advance came about fifteen years ago, with the introduction of antioxidants. These organic compounds are selected from several classes of organic derivatives and, when added in small amounts, serve to reduce the rate of atmospheric oxidation of rubber by a factor of four or five times. Since oxidation results in a complete loss of physical strength, the importance of this reduction in oxidation rate is apparent. Although the use of antioxidants is not a cure-all for poor compounding or improper vulcanization, it is serving to raise the general level of quality of rubber goods and extend the period of their useful life.

A radical change in vulcanization technique was introduced several years ago in connection with the continuous

[1] Bell Telephone Laboratories, New York, N. Y.

vulcanization of rubber covered wire. In this process highly accelerated rubber compounds have been developed which can be vulcanized in a fraction of a minute while the wire is traveling at high speeds from the insulating head through a long pipe under high steam pressures. Not only does this short cure produce a superior product, but this new process is also more economical and produces more uniform wire than the older processes of coiling on reels or in pans and vulcanizing for long periods in autoclaves.

The rapid increase in the use of latex in recent years represents another important advance. The development in methods of shipping, compounding, and vulcanizing latex has created an important branch of the rubber industry with the possibilities of expansion only partly realized.

Along with all of these important improvements in the quality of the soft vulcanized product numerous methods of testing and control have been developed and introduced to enable the manufacturer and consumer alike to be assured that the product will meet service requirements.

Problem of Vulcanization

It was not until the turn of the present century that scientific studies of the structure of rubber and the nature of vulcanization began in earnest. C. O. Weber at that time first postulated that rubber consisted of large molecules made up of isoprene groups arranged in long chains. The X-ray diffraction pattern now furnishes proof for this structure. Weber was also first to show that vulcanization involved a chemical reaction of sulphur with the rubber.

It often happens that technical processes are discovered which require years of scientific research to explain their mechanism fully. Such has certainly been the case in connection with the vulcanization of rubber, the mechanism of which has not been completely cleared up after a century. Theories attempting to explain the mechanism of vulcanization have been formulated by the score. In spite of the vast fund of scientific knowledge built upon the subject almost nothing is known regarding the changes occurring in chemical structure of the rubber molecules which account for the physical changes observed as the result of vulcanization.

An acceptable explanation of the vulcanization effect must be accompanied with scientific data showing the exact nature of the rubber molecules and the chemical changes occurring during vulcanization which account for the physical changes observed. It is not enough to state that vulcanization is the result of a chemical reaction of sulphur with the double bonds in the rubber molecule.

The huge size of the rubber molecule makes it possible for a very small quantity of sulphur, oxygen, or other chemical agents to have profound effects on physical properties. Rubber molecules contain hundreds of unsaturated carbon atoms each of which are points for chemical addition and for chemical linkage with carbon atoms in adjacent rubber molecules to form new molecules of still higher molecular weight and complexity. There are possibilities then of an almost infinite number of products and isomers with variations in quantity and position of the sulphur in the molecules to say nothing of the possible variations in the type of sulphur linkage involved.

The fact that vulcanization of rubber with sulphur under various states of organic accelerator activation produces products having wide variations in physical properties is sufficient evidence to point to the complexity of the problem.

It is also a well-known fact that the optimum physical properties result from various conditions of vulcanization and from the chemical combination of quite different amounts of combined sulphur. This fact has been cited by some in favor of a physical theory of vulcanization. This argument carries very little weight when one considers the variations which exist in the chemical activation of the sulphur by various accelerators and the variations in the molecular weight of the rubber under various conditions of treatment. In view of these variables and those previously stated it is not wholly unexpected that different quantities of combined sulphur are required to obtain the optimum physical change. As a matter of fact almost any variation in vulcanizing ingredients or in vulcanization treatment, to say nothing of variations in the crude rubber and its mastication, is reflected in the properties of the vulcanizate.

It has been held that vulcanization may result primarily from colloidal changes and that the chemical combination of sulphur is not the primary cause of vulcanization. It is true that in the vulcanization of milled rubber, a conversion of sol to gel takes place early in the process and that the gel on further vulcanization becomes firmer and stronger and exhibits reduced swelling. This change from sol to gel during vulcanization, however, is not a necessary part of vulcanization since in the case of latex vulcanization the rubber is largely in the gel state at the outset.

Effect of Hydrocarbon Structure

The problem of rubber hydrocarbon structure and the mechanism of elastic deformation as related to structure cannot be separated from the problem of vulcanization. The elasticity and strength of crude rubber appear to be due to the presence of huge hydrocarbon molecules containing a thousand or more "isoprene" units, $CH_2{-}\overset{CH_3}{\overset{|}{C}}{=}CH{-}CH_2$ which are linked together in long chains by primary valence forces. The rubber molecule becomes decreasingly elastic and increasingly plastic as its molecular weight is lowered by oxidative breakdown. It becomes softer, more adhesive, and more soluble in organic solvents as the molecular weight is lowered. Its maximum toughness and most perfect elasticity exist in the gel state. Except in the special case of latex vulcanization the crude rubber is made plastic by mastication on rolls or by other means. This process is known as breaking down, and it is well named because the large sol and gel molecules in crude rubber are truly broken down through the effect of activated oxygen which chemically combines with and ruptures the long hydrocarbon chains, thereby reducing their average molecular weight to a fraction of their original value. The extent of this reduction in molecular weight depends on the severity of the breakdown treatment. Well-plasticized rubber achieved by working the crude material on the ordinary laboratory milling rollers for about fifteen minutes has been found to contain molecules in a relatively narrow range of sizes with the average sized molecule containing about 500 "isoprene" units as determined by its viscosity in hexane.

When sulphur is added to this masticated rubber and the mixture heated, chemical combination of sulphur resulting in vulcanization occurs. It is known that proteins and amino acids naturally present in the crude rubber accelerate this effect, and if accelerators are added, the amount of sulphur can be greatly reduced and vulcanization consummated in much less time. The physical result varies not only with the molecular state of the rubber before vulcanization, but with the nature and amount of the sulphur employed. Different accelerators produce different physical effects in the same compound which leads

to the hypothesis that sulphur is converted by different accelerators to different states of activation and reacts with the rubber in various ways to produce these variations in physical properties.

The physical improvement upon vulcanization is greatest when the rubber has been broken down the least. Thus in latex vulcanization superior physical properties result. This fact points toward the hypothesis that active sulphur is the binding unit which ties together the rubber molecules as building blocks. The larger the molecules, the fewer will need to be the sulphur links to produce the unit and the stronger will be the resulting product.

It may be helpful to theorize on the basis that sulphur links the rubber molecules together by reacting with the double bonds. This so-called cross-bond or cross-linking theory so prevalent today is attractive and may ultimately be proved to be the correct one. It must be admitted, however, that no one has yet been able to determine the exact location of the sulphur on the rubber molecule or to show the type of sulphur linkage which exists. Improvement in X-ray technique, or the development of new

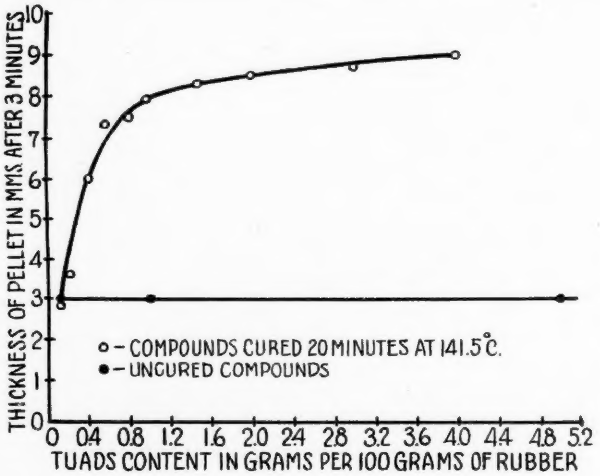


Fig. 1. Effect of Vulcanization with Tuads on Plasticity of Rubber (William Plastometer, 70° C.)

physical and chemical methods of approach, is needed in this problem.

Minimum Sulphur Required

The sensitivity of plastic rubber containing 5% zinc oxide to change when vulcanized with varying amounts of tetramethyl thiuram disulphide (Tuads) for 20 minutes at 142° C. is seen on the accompanying Figures 1, 2, and 3. Measurable effects were obtained when as little as 0.2% accelerator was employed. During vulcanization one molecule of this accelerator splits off one atom or 13.3% of highly active sulphur to combine with the rubber. It is seen from Figure 1 that the reaction of only 0.027% of sulphur with the rubber starts the change known as vulcanization as is evidenced by the decrease in plasticity. It is seen from Figure 2 that gelation results from the use of 0.2% Tuads and that swelling in hexane is reduced to nearly its minimum value by the use of 1.5% Tuads. The tensile strength starts to increase with the use of 0.4% Tuads corresponding to 0.053% active sulphur as is shown in Figure 3. Bruni and later Stevens found 0.15% combined sulphur was required to start vulcanization. It is also to be noted in Figure 3 that vulcan-

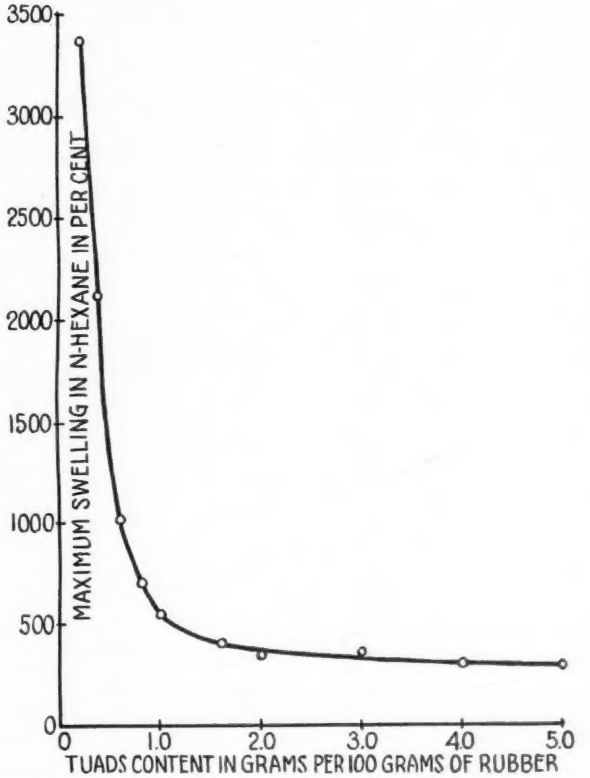


Fig. 2. Effect of Vulcanization with Tuads on Swelling of Rubber in N-Hexane

ization is practically complete when 2% Tuads was employed or when 0.27% sulphur combines with the rubber. These values of combined sulphur are based on the assumption that all of the theoretical amount of sulphur released by the accelerator combines with the rubber.

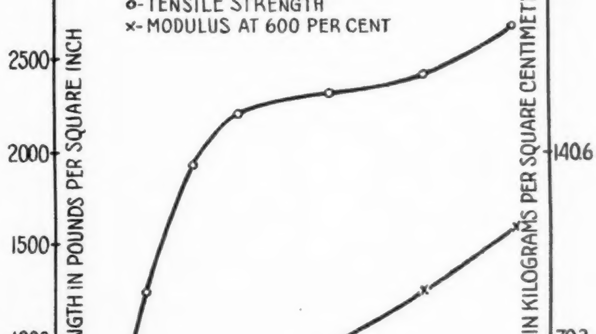


Fig. 3. Effect of Vulcanization with Tuads on Tensile Properties of Rubber

In a plastic rubber where the average sized molecule contains about 500 isoprene groups, if the vulcanization reaction involves the proportion of one atom of sulphur reacting with one molecule of rubber either intra- or intermolecularly, the required amount of sulphur would be 0.1%. If one atom of sulphur reacted with two molecules of rubber, only 0.05% sulphur would be required. It is seen, therefore, that the amount of combined sulphur found by experiment to start vulcanization as measured by tensile strength compares quite well with the calculated amount on the basis of one sulphur atom reacting with two rubber molecules. In the case of ebonite it is known that the reaction requires the chemical combination of one atom of sulphur for each double bond yielding the product corresponding closely to $(C_5H_8S)_x$. This, however, proves very little with regard to the nature of sulphur linkage in soft vulcanized rubber since the small quantity of sulphur required may react in various ways either intra- or intermolecularly and not influence the composition of ebonite appreciably when the reaction is carried that far.

In crude rubber which has been plasticized or otherwise broken down by oxidation the molecules contain a small quantity of combined oxygen which is likely to be located as end groups, possibly as hydroxyl. During vulcanization these groups may interact by condensation or they may influence the reaction of sulphur with the rubber or both. The possible effect of this combined oxygen has hitherto not been given consideration.

The fact that rubber gels when reacted with only a few hundredths of a per cent. of active sulphur, may be taken to indicate that this sulphur reacts intermolecularly serving to link together a number of rubber molecules to form a gel. Further reaction of sulphur with this gel may increase the number of linkages between the rubber molecules, thereby accounting for its greater strength and resistance to swelling. Sulphur may also react intramolecularly as well as between separate molecules depending upon its chemical activity. It is known, for example, that vulcanization of rubber with sulphur alone requires larger quantities of combined sulphur to produce a given change in physical properties than is the case with sulphur activated by accelerators. The weaker nature of the rubber-sulphur vulcanizate may be taken to indicate that a considerable part of the sulphur reacts intramolecularly and is not effective in cross linking and strengthening the rubber molecules.

Sulphur may also react by substitution splitting off hydrogen sulphide; however, the existing evidence indicates that this reaction is of minor importance in vulcanization. Substitution occurs only to a very small extent in the formation of ebonite under proper conditions, but is increased by use of excess sulphur and increased temperature as would be expected.

Vulcanization of plastic chloroprene polymers by heating them with a metal oxide brings about gelation as does vulcanization in the case of rubber with sulphur. Because sulphur is not required to vulcanize polychloroprene, some have concluded that sulphur plays no direct part in rubber vulcanization. This is taking a narrow view of vulcanization since active oxygen and other substances also vulcanize rubber and sulphur is also an aid in the vulcanization of polychloroprene. Although the thought is prevalent that the metal oxide functions as a polymerization agent, the nature of this reaction is apparently not fully understood. Since gelation occurs in vulcanizing Neoprene, a better understanding of the nature of gel formation in the vulcanization of unsaturated high polymers is of utmost importance in connection with the vulcanization process.

Theories of Elasticity

Physicists have been active for many years attempting to explain the underlying mechanism of the high reversible elasticity of rubber. The more recent views on the subject consider all substances possessing flexible main-valence chains as having reversible elasticity provided the proper temperature is selected where they become flexible. True rubber-like elasticity, however, is reserved for those long flexible chain molecules which may be linked together in a flexible network. The flexibility is believed to be the result of a high degree of freedom of rotation of the units around the normal carbon linkages. Recent theory states that rubber-like elasticity will be manifested only if the long-chain molecules possess sufficient internal mobility. In stretching rubber the long-chain molecules are alined in the direction of stretch, and in retraction the molecules rearrange in a random fashion. Rubber elasticity has been shown to be analogous to the elasticity of a gas on the basis of thermodynamic considerations.

Helpful as are the various physical theories of elasticity and vulcanization, there is great need of more convincing experimental evidence for their support. Details are now lacking as, for example, when speaking of long chain molecules, one immediately wants to know "how long?" Also present methods do not enable one to distinguish adequately between the effect of primary valence and van der Waal forces in high polymers.

Plasticized crude rubber showing very little elasticity may contain molecules with 500 or more isoprene units on the basis of viscosity molecular weight data. Gutta percha hydrocarbon and certain high polymeric esters and amids become plastic or liquid in a narrow temperature range and do not show the high reversible elasticity at any temperature. Gel rubber in crude rubber with a molecular weight believed to be in excess of 200,000 resembles well vulcanized rubber as regards high reversible elasticity. When this gel rubber is broken down to sol by oxidation, high reversible elasticity is retained at an average molecular weight ranging from about 200,000 to 100,000. As breakdown proceeds and the molecular weight drops below 100,000, the rubber becomes increasingly plastic and decreasingly elastic. Another case where molecular weight appears to be a major factor in determining properties is in the case of the chemically saturated rubber-like polymer prepared from isobutylene, which shows increasing elasticity as its molecular weight increases. Like rubber hydrocarbon, it shows excellent reversible elasticity at average molecular weights of 200,000 or higher.

Substances showing high reversible elasticity are highly amorphous and they lose their elasticity to the extent they become crystalline. The crystalline nature and low elasticity of frozen crude rubber and of gutta percha hydrocarbon at ordinary temperature are cases in point. In the amorphous condition the association forces between the long fiber molecules are so low as to offer little restraint to their elongation or alinement and to their retraction. This view requires, of course, that the molecules are curled or folded in the unstressed state.

The view may be taken that in elastic linear polymers the restraining forces at high elongation originate from the resistance to shear or slippage between the long chains. As the molecular weight increases, the shearing resistance increases proportionately which explains the higher modulus and lower plasticity of gel rubber as compared with sol as well as the properties of polyisobutylene as molecular weight increases. The decrease in association forces, when rubber is moderately heated, serves also to explain

(*Continued on page* 88)

The Rubber Industry Abroad Fifty Years Ago

L. Thakar

FOR several decades after 1736, the year in which de la Condamine made his first report on rubber, France was in the forefront in investigating it. Infected by de la Condamine's enthusiasm, Macquer, Herissant, and others examined and tested the new material, calling on all the knowledge and experience gained in other fields. They succeeded in dissolving the rubber in ether, turpentine, etc., and producing thin elastic skins as well as thin rubber tubes for laboratory apparatus, and bougies, catheters, and probes for surgical purposes.

Berniaud, seeing among the curiosities of the Duc de Chaulnes a small piece of a flexible reddish substance, said to be Chinese gum elastic, immediately got the idea of coloring rubber, and succeeded, too, by kneading colors into the rubber, in obtaining both red and green samples. Fourcroy, with the help of Vauquelin, attempted a complete analysis of latex, and it appears that he detected the presence of certain sugars in the latex. The material he had to handle was obtained from places as far apart as the island of Reunion in the Indian Ocean, and Brazil, and when received, it was in a high state of decomposition. He advised the addition of an alkali to future shipments of latex. Grossart discovered, among other things, the property of rubber to adhere to itself and made tubes and the like by causing rubber strips to be slightly softened by brief immersion in suitable media, then rolling them around mandrels and applying pressure.

All this and more was accomplished before the end of the eighteenth century, and we see the germs of what may perhaps be called the oldest branch of rubber manufacture in Europe, the production of surgical goods. But it was not until the British began to take rubber seriously that the foundations of a regular rubber industry were laid. However these foundations would not have proved very secure had not first Goodyear in America and later Hancock in England discovered vulcanization—more than 100 years after de la Condamine made his original report—and thereby given strength and stability to the industry as well as to the articles it produced.

Having spread to England about 1790, interest in the utilization of rubber was at first chiefly confined to the production of surgeon's probes and erasers. At the same time numerous attempts were made to perfect a spreading solution for waterproofing fabric, but for a long time no success was had.

When Hancock turned from his mechanic's tools to rubber, he began by making erasers, but he early realized the wider possibilities of the new material and soon embarked on that astonishing list of discoveries and inventions which have earned for him in England and the Continent the name of "Father of the Rubber Industry."

The interdependence and interaction of human advances can hardly be better illustrated than by the course of the development of the rubber industry. After the first steps toward the solution of the scientific problems of rubber had been taken with much success by the French, and some of the possibilities of the new material revealed, the British, or rather Hancock, devised the most practical means at the time to realize these possibilities. Not ten years after he had started his own factory, Hancock went to France, installed his newly perfected machinery for Rattier & Guibal at St. Denis, and instructed the firm in its use for producing blocks of rubber, solutions for rubberized fabrics, and balls. And so, in 1828, the French rubber industry got its real start through an Englishman.

It was about this time, too, that the manufacture of rubber goods was being introduced into Germany, Holland, and Russia. For in 1828, J. N. Riethoffer took out an Austrian patent, and François Fonrobert obtained a German patent, for producing durable rubber thread by covering unvulcanized cut thread with wool, silk, or linen yarn. In 1829 Fonrobert erected the first German factory for producing elastic fabric in Berlin. Again in 1828, the Dutch chemist Jan van Geuns was experimenting with rubber in the town of Haarlem and by 1837 was making water hose not only for the Dutch navy, but also for export, among other countries, to Russia. Attempts have been made to show that van Geuns anticipated Goodyear and Hancock in discovering the beneficial effect of sulphur in rubber. It is claimed that he utilized the observation made by the German, Friedrich Ludersdorff, around 1830 that a film of rubber made from a solution of rubber in sulphured spirits of turpentine was not sticky.

Finally around 1830, or soon after, Henry Kirstein, evidently a German, opened the first rubber factory in Russia at St. Petersburg, now Leningrad.

The interest in rubber and rubber manufacture was therefore fairly widespread in Europe even before the discovery of vulcanization. But the progress made so far, surprising enough when the difficulties and disappointments that beset the early manufacturers are considered, received its real stimulus after Goodyear in 1839 and Hancock in 1843 had made their revolutionary discovery which at once put the industry on an entirely new basis.

In the next fifty years after vulcanization was discovered the industry progressed to new heights. There seems to have been no end to the curiosity about rubber or to the enterprise displayed in finding new applications, many of which, to be sure, were more curious and ingenious than useful. Manufacture had meantime spread also to Belgium, Spain, and Italy; outside of Europe, even far-off Japan began to make the first fumbling attempts at manipulating the raw material of infinite uses. Rubber goods were bought and used from one end of the globe to the other. Rubber footwear from America was bought by China at least three decades before 1889.

Great Britain

Looking back at the rubber industry as it was outside of America 50 years ago, we find Great Britain still in the lead. The pioneers of the industry had built solidly and well, and many of the rubber companies operating at that time are still in existence today. The five oldest had already passed the half century mark and are therefore now more than 100 years old.

Pre-Vulcanization Period

The Nestor of them all is James Lyne Hancock, Ltd., whose origins go back to 1820 when Thomas Hancock first opened a small shop for working rubber and in the same year took out his first patent. This was for "an improvement in the application of a certain material to various articles of dress, that the same may be rendered more elastic." From raw rubber he had cut thin strips that were to be sewn into garters, wrists for gloves, and other apparel to make them fit better. It was this appli-

Charles Macintosh

Thomas Hancock

cation for rubber which may be said to have directed his inventive course, for it was the wish to utilize the waste left after cutting the strips that led to the invention of the masticator in 1820. After that one discovery brought the next, and one invention followed the other, until Hancock had designed masticating, mixing, cutting and spreading machines as well as presses for making rubber blocks, climaxing all this by his independent discovery of vulcanization. Long before this last event, he was producing a wider variety of goods than any other manufacturer of his day. Obtaining a license from Macintosh to use the latter's new method of making solutions for waterproofing fabrics, he proceeded to make inflatable air-beds, besides waterproof garments. The first air-beds had only one chamber, and after they had been inflated, anyone trying to rest on them, rolled off. But he solved the difficulty by constructing his air-beds with several narrow chambers, as is still done today. About 1826 he was making hose pipe for brewers. After he had capped all his previous inventions by finding out in 1843 how to improve rubber by vulcanizing it, the list of his products grew astonishingly, until in 1857 it also included balls, bands, tubing, fire hose, door springs, various small mechanical goods, footwear for special factory purposes, solid tires, and inflatable tires. There is no evidence as to whether or not these pneumatic tires were made according to Thomson's patent of 1845, or is it definitely known that any vehicle actually ran on them.

Hancock was also the first, in 1855, to suggest starting rubber plantations in the Far East and to discuss the matter with Sir William Hooker, the director of Kew Gardens, who began to take up the matter around 1859.

The firm established by Hancock in 1820 and later known as James Lyne Hancock, Ltd., remained in the family until 1935 when it was acquired by the British Tire & Rubber Co., Ltd., of which it is now a subsidiary.

The second oldest British firm, Chas. Macintosh & Co., Ltd., now associated with Dunlop Rubber Co., Ltd., was founded in 1823 by Charles Macintosh, a Glasgow chemist whose business had originally been that of manufacturing dyes and mordants, but who became interested in the problem of waterproofing fabrics. After many years of experimentation he discovered the value of coal tar naphtha as a solvent for rubber and developed his method of making waterproof garments and other articles by spreading a rubber solution between two layers of cloth, a process which he patented in 1823. Although the process gave results superior to any hitherto obtained and was considerably improved within the next few years by mastication of the rubber on Hancock's machine before being dissolved and by the application of the solution by means of Hancock's newly designed spreader, yet the products suffered more or less from the same defects as other goods manufactured at the time. They also became tacky in warm weather and hard in the cold; these troubles were ended only by the discovery of vulcanization.

David Moseley & Sons, Ltd., founded in 1833, also started the production of waterproof fabrics. Today the firm makes a wide variety of goods including tires, mattresses, hose, molded goods, waterproof garments, etc.

Finally, following closely upon each other, came the establishment of the firms now known as P. B. Cow & Co., started in 1836, and William Warne & Co., Ltd., begun in 1837 as The London Caoutchouc Co., and, then as now, specialized in mechanical and surgical goods, although the range of goods today is much wider.

Early Post-Vulcanization Days

For several years after the discovery of vulcanization the patent situation apparently restricted the number of new enterprises, just as the difficulties of rubber manufacture had done in pre-vulcanization days, for the group of companies that ranks next in point of seniority is a considerably younger one than the first.

But meantime the advances in engineering, communications, and industry in general, were opening up new fields for rubber and also bringing to the attention of rubber manufacturers new materials including gutta percha and balata. Accordingly the products of these younger companies showed greater diversity. On the other hand, after Alexander Parkes discovered the cold-cure process in 1846, there was greater interest than ever in the first favorite of British rubber men, proofed fabrics, and this type of goods became and remained for a long time practically a British monopoly. Rubberized fabrics, therefore, continued for years to be the starting point of many of the younger firms.

One of the best-known firms—internationally as well as nationally—The India Rubber Gutta-Percha & Telegraph Works, Ltd., (now controlled by the British Tire & Rubber Co., Ltd.) began in this way. The outfitters, S. W. Silver & Co., operated a small waterproofing works at Greenwich. In 1852 the factory was transferred to a new location and prospered to such an extent as to draw a large number of residents, and eventually the district be-

came known as Silvertown, a name now familiar everywhere because of the rubber goods made there. The company was incorporated in 1864, under the title Silver's India Rubber Works & Telegraph Cable Co., Ltd.

Another firm started in those days in much the same way, J. Mandleberg & Co., founded in 1850, manufactures rainproof garments and rubber-proofed piece goods.

Illustrative of the new trend, was the firm of George Spencer & Co., formed in 1851 to manufacture rubber springs for railways according to patents taken out by George Spencer. The firm was still working under this name in 1889, for it was not until 1891 that it amalgamated with Stephen Moulton & Co., which had been founded in 1848 by Stephen Moulton—one time English agent for Charles Goodyear—and the present well-known firm of George Spencer, Moulton & Co., was formed. The company still specializes in the same type of goods.

The North British Rubber Co. is another example of the widening sphere of rubber. Encouraged by the rapidly growing foreign demand for American rubber footwear, an American, Henry Lee Norris, of the firm of James Bishop & Co., New York, decided to establish a footwear factory in Britain. Owing to the patent situation, he started in Scotland in 1855 instead of England as he had originally planned, and in 1856 the first British factory to produce rubber footwear under the Goodyear patent was registered. It was known as the North British Rubber Co., Norris & Co., and the first directors were Henry Lee Norris (managing director) Spencer Thomas Parmalee, William Judson, Benjamin Franklin Breeden, Christopher Meyer, James Bishop, James A. Williamson, and John Ross Ford. In 1865 the American shareholders sold their interests to various Scottish shareholders, and Scottish directors were elected to the board. Rubber boots and shoes were at first the only products, but three years later belting, packing and other mechanicals were added, and still later waterproof clothing, thus reversing the more usual procedure of companies at the time which started with waterproof products and then went on to manufacture other rubber lines. The firm appears to have prospered from the outset and by 1868 was employing 600 workers and making a large variety of goods. It is not quite 50 years since W. E. Bartlett, managing director of the firm at the time, invented the type of detachable tire that became known as the Clincher.

Another important firm that was well-established 50 years ago was the Leyland Rubber Co., at present well-known as the Leyland & Birmingham Rubber Co., Ltd. Its origin goes back to 1862 when James Quinn started a small factory for weaving canvas hose at Leyland, near Preston, and soon afterward began manufacturing rubber goods on a small scale. The undertaking prospered and grew rapidly. In 1898 it merged with the Birmingham Rubber Co. and the Stanley Morrison Co. to form the firm under the name by which it is now known.

Among the firms established in the '70s and still surviving today is J. J. Franklin & Sons, Ltd., founded in 1870 to make surgical goods from cut sheet. The firm has added druggists' sundries, bathing accessories, toys, etc.

The Northern Rubber Co., Ltd., at present well-known producer of mechanical rubber goods and waterproofed and air-proofed piece goods and garments, was established a year later. The Victoria Rubber Co., founded in 1879, now specializes in proofed fabric for all purposes, printers' rollers, and offset blankets.

Activities in the Eighties

By 1880 a great many new uses had been found for rubber; not all of these applications proved immediately practicable. Some were to lie dormant for many years, as rubber paving, which was first used in 1870 on the road under the St. Pancras Hotel, but was disregarded for several decades. The full possibilities of others, as tires, were yet to be revealed. Bicycles had already been introduced into England from France around 1870, but were still fitted with solid tires and were used almost exclusively by athletes. But the development of general industry and the growing familiarity with the virtues of rubber were constantly expanding its field. One of the very latest directions from which an increased demand for rubber was coming was the electrical industry. Edison had just perfected the incandescent lamp which served to stimulate interest in rubber insulations for wires and cables. A similar situation was created by the telephone.

The growth of the rubber industry as a whole is illustrated by the fact that world rubber consumption in 1850 was only 1,467 long tons, mostly from Brazil, and in 1880 was 12,730 tons. Two-thirds of the latter amount was supplied by Brazil; and the rest, in practically equal shares, by other South American countries and by Africa, an increasing source of raw rubber.

The rubber industry in England had by now become important enough to require a special trade paper, and in 1884, the first issue of a paper of this kind, *The India Rubber Journal,* a monthly publication, appeared. About the same time several new rubber factories were established. Among those still in existence are: James Walker & Co., Ltd., (1884) manufacturer of packing and mechanical rubber goods; Dermatine, Ltd., (1884), also manufacturing packing, in addition to hose and belting; the Avon India Rubber Co., Ltd., (1885) later prominent as producers of tires of all kinds, flooring, mechanical goods, sporting goods, etc.; and finally, the Reliance Rubber Co., (1889).

Toward the end of that same year, or to be more exact, in November, 1889, was formed in Belfast, Ireland, a company that was named the Pneumatic Tire & Booth's Cycle Agency, Ltd., which had just bought the patents for Dunlop's pneumatic tires. It is not necessary to go into the details of the phenomenal rise of the company that was to become world-famous as the Dunlop Rubber Co., as these are already well known. In addition to the Chas. Macintosh Co., Ltd., the present subsidiaries of the Dunlop company include the New Liverpool Co., which was established in 1859 to manufacture rubber footwear and was one of the earliest in this field in Britain.

Use of Gutta Percha and Balata

Land and submarine telegraphy became commercial propositions about the middle of the nineteenth century, and from the outset rubber and gutta percha were used for insulation purposes. Gutta percha, which had been introduced into England about 1843, was the preferred material until the further development of uses of electricity after 1880 increased the demand for rubber insulations. However submarine cables continued to employ gutta percha. Two British companies that had collaborated in the manufacture of gutta-percha insulated submarine cables almost as soon as these became successful were the Gutta Percha Co. and Glass Elliott & Co. In 1864 the two firms merged and formed the Telegraph, Construction & Maintenance Co., Ltd. Of much more recent development is the British Insulated & Helsby Cables, Ltd., which also was formed after the amalgamation of two older companies, the Telegraph Mfg. Co., founded in 1886, and the British Insulated Wire Co., established in 1890.

In its early days gutta percha was used for a great variety of different purposes, among which was belting. But, for this use it gave way to balata. One of the most successful manufacturers of this type of belting in England is the firm of R. & J. Dick, founded in 1846. More

M. Guibal

than 50 years ago it had already started to make its now widely known balata belting.

Germany

In the early years of its development the rubber industry in Germany, as elsewhere, drew heavily on England, and to a smaller extent on America, for information and guidance regarding methods and factory practice. A number of the older rubber manufacturers started as agents handling English rubber goods, then undertook to complete some partly finished article and by degrees became independent rubber manufacturers. Until about the end of the last century German manufacturers of machinery for the rubber industry advertised that their products were made in exact accordance with English and American design and process. Fifty years ago, Germans had just begun technological and scientific development in the rubber trade.

German sources usually credit François Fonrobert with having laid the basis for a German rubber industry when about 1829 he opened a factory near Berlin for making elastic webbing. Around 1828, it is said, he in Germany, and J. N. Reithoffer in Austria, obtained patents for making covered rubber thread. The firm of François Fonrobert was moved to Finsterwalde in 1882 and now makes soft rubber goods and rubberized fabrics.

Further progress of the rubber industry seems to have been practically at a standstill until after the discovery of vulcanization, but in the next 20 years following that event several firms were established which are now among the leaders in the local industry. One of the oldest of these is the Kolnische Gummifaden-Fabrik vormals Ferd. Kohlstadt & Co., founded in 1843, which makes rubber thread and elastic goods. H. Rost began in 1848 to manufacture rubber surgical goods, but about 50 years ago abandoned this for the production of gutta percha and balata articles. In the last few years this firm has developed a synthetic material with gutta-percha-like qualities, known as Guttasyn. A branch of the rubber footwear firm established in France by the American, Hiram Hutchinson, was started in Mannheim in 1850, and this company, Gummiwerk Hutchinson, is still affiliated with the parent concern in France.

The manufacture of hard rubber was introduced into Germany about 1856 by the New York-Hamburger Gummiwaren Compagnie, and in the same year the well-known Harburger Gummiwaren Fabrik, Phoenix A.G., was founded. The Rheinische Gummiwarenfabrik Franz Clouth A.G. was started in 1862, and a year later Pahl, Dortmunder Gummiwaren-Fabrik Wilhelm Pahl. The heads of both of these firms later played important parts in the development of the German rubber industry.

By 1868 there were in Germany 36 rubber factories employing 1,788 persons. After the various German states had been united in 1871 to form the German Empire, industry in general began to develop on a hitherto unknown scale, and the rubber branch also moved ahead rapidly. At this time several companies were started which were to become among the largest and most important in the industry, as the Metzeler Gummiwerke A.G. (1871) and most famous of all, the Continental Gummiwerke A.G. (1871). The remarkable growth of the rubber industry at this period is illustrated by the fact that by 1875 there were 111 rubber factories employing 5,495 persons, an increase of over 300% in both the number of establishments and workers in a period of seven years.

The expansion of the '70s continued through the following decade, and in 1889, Germany was importing around 4,000 metric tons of raw rubber and gutta percha and exporting about the same amount of rubber manufactures. These included 1,850 metric tons of soft rubber goods, of which about half were partly finished, 466 tons of hard rubber goods, 416 tons of toys, 303 tons of rubberized and elastic fabrics, 34 tons of elastic webbings as well as 142 tons of rubber-coated hose, belting, and wagon covers. In the fiscal year 1888/89 Germany exported to America rubber goods to a value of $168,309, but took in exchange American rubber manufactures representing a value of only $90,835.

By 1889 the *Gummi-Zeitung* had been in existence three years, having been started on October 1, 1886. This was the second trade paper in the world to serve the rubber manufacturing industry.

France

It is interesting to compare the tireless curiosity of the French investigators in the earliest days of rubber and the apparent lack of interest shown later. Where the French had first led, they were after a time content to follow, and the development of the French rubber manufacturing industry was largely indebted to foreign methods and even foreign enterprise.

When the first French rubber factory was established in 1828 by Rattier & Guibal, it was with the aid of Hancock; when the firm of Barbier & Daubree was started in 1832, it was at the suggestion of the latter's British wife, a niece of Macintosh, who in the beginning even helped to run the enterprise. It was an American, Hiram Hutchinson, who in 1849 started the firm now widely known as Etablissements Hutchinson and introduced the manufacture of rubber footwear to Europe. An Englishman had to be brought over by Torrilhon (now Société Nouvelle des Etablissements Torrilhon) when he decided in 1850 to start the manufacture of rubber-surfaced fabrics for rainproof garments and the like, for no one in France at that time knew how to make the black, rubber-coated fabrics that were among the Macintosh specialties. Felix Berguerand, who in 1855 founded the firm at present known as F. Berguerand et Cie., introduced from England the manufacture of cut sheet.

However, if foreign method and foreign enterprise were important factors in the early development of the French rubber industry, French taste, initiative, and courage were not lacking to continue along the lines laid out and to expand beyond anything originally planned.

G. B. Pirelli

Rattier & Guibal began by making chiefly balls according to a process developed by Hancock. But soon they added elastic webbing for garters and suspenders. The French claim that they originated the elastic webbing industry, and according to Dubosc,[1] elasticity in garments was hitherto achieved by means of fine brass spiral springs. In the case of suspenders, these springs were encased in soft leather and attached at the ends. In 1826 a Frenchman, Antheaume, thought of making elastic suspenders by weaving fabric in a special manner so that the springs could be inserted in the fabric after which he invented a special loom for the purpose. He did not patent his process, and it was soon widely copied. Rattier & Guibal decided to improve on it and substitute rubber thread for the wire springs. Hitherto rubber thread had been made by cutting blocks of rubber first into sheets, then into narrow strips. The thread obtained in this way was short, but as the rubber was unvulcanized, it was comparatively easy to join the ends and make longer lengths. About 1829, Rattier & Guibal devised a simpler and more efficient method of obtaining long lengths of rubber thread. According to a report on the subject issued at the time by the Société d'encouragement pour l'industrie nationale, the hollow, pear-shaped forms in which raw rubber was received from Brazil in those days were first dilated and cut into two hemispheres, which were flattened and cut spirally into ribbons, which were again cut to the required degree of fineness. These threads were then covered with cotton, wool, or silk and the covered thread woven into elastic fabrics. The firm obtained a patent for this process on March 31, 1830. The French also claim that this method of making thread and elastic webbing spread to Austria, England, and the United States. However it was not until more than a decade later, when vulcanization was introduced, that elastic webbings became successful.

Rattier & Guibal appear to have separated in 1835. Guibal left no successor when he died, but the business left by Rattier eventually in 1882 passed into the hands of the Société générales des Teléphones, at present Société Industrielle des Teléphones. Recently this firm made a separate company of its rubber section, Le Caoutchouc S.I.T., with a capital of 30,000,000 francs.

The firm started by Barbier and Daubree passed through several hands before it was eventually acquired by the Michelin brothers and became world-renowned.

Hiram Hutchinson's business remained in American hands until 1898 when it was bought by French interests and reorganized as Société des Etablissements Hutchinson, now a leader in the French rubber industry.

Several other companies which were started between 1850 and 1889, still survive. The "Dynamic," founded in 1851 by Lejeune, Chapel & Cie., changed hands twice before it received its present name and organization. Technical and electrical goods, tires, and tubes are the chief products.

Maurel Freres & Cie., founded in 1853, makes rubberized fabrics and apparel. Rollin et Cie. (1854) specializes in belting and mechanical goods. Schoenfeld Freres (1854) specializes in molded goods. This company was among the first to use cut sheet and for a time was the only firm in France making transparent dipped goods. Victor le Renard & Fils (1858) makes all kinds of soft and hard rubber mechanical goods. Bognier et Burnet (1887) started by producing toys, dolls, and balloons and later added all kinds of surgical goods made from cut sheet. The firm still features unworked cut sheet among its products.

P. Lacollonge, who in 1882 founded the concern that bears his name, early became interested in the problem of attaching hard rubber to metal. In 1885 he made the first hard-rubber lined drums and tanks for transporting hydrochloric acid, thus permitting acids to be handled in bulk for the first time. He used sheets of rubber, plain or reenforced with wire gauze to line the containers, and to insure better union of rubber to metal made holes through the latter through which passed hard rubber plugs held in place on the outside by appropriate rings. In 1886 the method was improved; the lining consisted of a layer of rubber specially prepared to adhere well to metal and another layer having special acid resisting qualities, with a sheet of thin metal gauze between the two layers, the whole being united by strong pressure. Later he applied his process to a great many metal surfaces.

The firm established in 1884 by Victor Thillier to manufacture surgical goods was taken over in 1897 by P. Viault, who established the existing firm of that name.

Finally mention may be made of Etablissements Wattelez et Cie., founded in 1885, and now the largest reclaimer of rubber in Europe.

The French rubber industry which in 1828 counted but a single factory had 45 factories in 1860. This number it is claimed increased to 160 by 1875, but curiously enough this is also the number said to be operating in France in 1900. Consumption of raw rubber was three metric tons in 1827; this rose to 1,250 metric tons in 1870 and to 2,500 in 1890. The value of the output of the French rubber factories in 1889 was estimated at 75,000,000 francs.

Italy

Apart from a brief interest in rubber shown by individual investigators in the latter part of the eighteenth century, Italians did not appear to have occupied themselves much with rubber until after the middle of the nineteenth century. According to Dubosc,[2] Cavallo, an Italian chemist, was in London about 1780 studying the problem of dissolving rubber with Winch, who was following Macquer's experiments. Cavallo conceived the idea of making smooth rubber tubes of uniform thickness by repeatedly dipping clay molds into a rubber solution. The same authority states that Fabroni, a well-

[1] "Encyclopedie du Caoutchouc et des Industries qui s'y rattachent," pp. 445-46.
[2] *Ibid.*, pp. 423, 424, 426.

known Italian road engineer of his day, who was also interested in chemistry, tried to discover a cheap solvent for rubber and succeeded in 1791 in dissolving rubber in petroleum. This was a little known material at the time, and Fabroni obviously did nothing more with his discovery.

The Italian rubber industry was really started in 1872, when the young engineer, G. B. Pirelli, opened a rubber factory at Milan. For over 20 years this was the only rubber factory in all Italy. The company founded by young Pirelli has become known as one of the leaders in Europe, and the research work done in its laboratories is today appreciated by rubber chemists the world over.

Netherlands

Bordering on Germany, practically next door to France and close to England, the Netherlands is peculiarly well situated to become acquainted early with the latest foreign developments in science and industry. It is not surprising that the tiny kingdom soon learned about rubber and that curiosity about the puzzling material spread there. In 1828 a Dutch chemist, Jan van Geuns, began to experiment with rubber and started the first rubber factory in the country. The claims made for him that he was actually the first to produce rubber goods improved by sulphur have already been mentioned. Whatever the foundations for these claims, the fact remains that he produced water hose of sufficiently good quality to be able to export it. By 1839 he had to expand his works; in 1841 he took a partner to whom he handed over the management of the business in 1847. The firm was acquired by Allard Merens in 1876, who later was joined by his brother, and the concern, now known as N. V. voorheen Gebroeders Merens, was formed. It still flourishes at Haarlem and manufactures belting and technical goods of rubber, asbestos, fiber, and ebonite.

Another old-timer is Bakker & Sons, of Ridderkerk, established in 1879 to produce mechanical goods.

Russia

To rubber men one of the great surprises of the Chicago World's Fair of 1893 was the discovery that the most impressive exhibit of foreign rubber goods had come from Russia. At this time few in America knew that Russian rubber footwear had for decades had an enviable reputation for durability in many European countries, much less realized that Russia was then the world's biggest exporter of rubber footwear.

The Russian rubber industry was founded soon after 1830 when the first factory was established in St. Petersburg by Henry Kirstein. Development at first was slow; in 1852 there were only four factories; but as the quality of the products was poor and the price high, all except Kirstein were forced to close in 1853. The government then came to the assistance of the infant industry by raising duties. Immediately the trade revived, and by 1860 five factories were employing 298 persons and producing goods to a value of 412,000 rubles.

In 1860 the Russian-American India Rubber Mfg. Co., later to be widely known as the Krasnye Treugolnik (Red Triangle) was established at St. Petersburg with a capital of 500,000 rubles to manufacture rubber footwear. Despite its name the company had neither Russian nor American directors or stockholders—all were German. It soon absorbed Kirstein as well as most of the smaller concerns that rose from time to time and by 1890 was the largest rubber manufacturing concern in the world. It employed nearly 3,000 persons—half of whom were women and the annual output of shoes was almost 5,000,000 pairs with a value of 13,500,000 rubles; while the capital had been increased to 6,000,000 rubles. An American who visited it in 1895 was amazed at the size of the plant, two buildings of which alone had a floor space of a little over 19 acres. Wages were low, but the workers were well cared for; nurseries, doctors, hospital facilities, rest-houses for convalescents were provided as well as a pension fund for the temporarily disabled and retired. Few things astonished this visitor more than the sight of the huge cauldrons of tea that were constantly being brewed and from which the workers were served without stint.

The company's footwear output, which for at least three decades practically constituted the entire Russian output of these goods, was 220,223 pairs in 1860-61; 1,804,634 pairs in 1870-71; 2,313,378 pairs in 1880-81; 3,300,000 pairs in 1886-87; and 4,675,000 pairs in 1891. An export trade was developed early, and large amounts went to Sweden and Norway, via Germany. The following figures compare the growth of total Russian footwear exports from 1888 to 1895, shipments to Sweden and Norway being obviously included in the exports to Germany.

	Pairs	
	1888	1895
Germany	326,016	2,583,936
Denmark	16,560	60,480
Holland	7,344	720
Belgium	5,472	12,816
France	....	41,328
Total	355,392	2,699,280

Until 1888 the Russian rubber industry and Treugolnik were practically synonymous, for there were no other factories at the time outside of one or two small ones. The best known of these was Mundel's works in Riga, started in 1864 to make footwear and surgical goods; it employed about 100 persons and produced goods worth 200,000 rubles.

In 1888 the Russian-French India Rubber Gutta-Percha & Telegraph Works Prowodnik, generally known simply as Prowodnik (meaning "Leader") was formed by French and Russian interests with a capital of 700,000 rubles. Output was at first confined to smaller articles, but gradually asbestos goods, tires, and rubber footwear were added. The company lived up to its name, it became a leader in the Russian rubber industry; the first Russian automobile tire came from its works, and by the time the World War broke out Prowodnik tires were seen in many European cities and even in England and America. In addition Prowodnik sales agencies for rubber footwear were to be found in every country in Europe as well as in Siberia, Persia, China, and Australia. In 1916, the concern was transferred to Moscow on account of the German advance; like the Treugolnik, it now probably forms part of the Soviet rubber industry.

Japan

It was telegraphy and telephony that really gave the rubber industry its start in Japan more than fifty years ago when Japanese began by making rubber insulated wires and then went on to other articles. There were at least two rubber factories operating in Japan 50 years ago. The first was formed in 1880 at Tokio under the name of Toyo Gomu Seyzo Kaisha, or Oriental Mfg. Co., and at first produced insulated wires and minor mechanical goods; later on soles for native footwear and rubber hose were added. In 1884 the Mitatsuchi Rubber Co. was established with a capital of $40,000. It was the first to make rubber footwear in Japan and was for a long time the only one in the country to do so.

(*Continued on page* 88)

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DEVOTED TO THE APPLICATION AND DEVELOPMENT OF

INDIA RUBBER WORLD AND ELECTRICAL TRADES REVIEW

CAOUTCHOUC GUTTA-PERCHA AND ALLIED INDUSTRIES

CELLULOID — ASBESTOS

HEVEA GUIANENSIS — DICHOPSIS GUTTA

Vol. I. No. 1. NEW YORK, U. S. A., OCTOBER 15, 1889. $3.00 Per Year. Single Copies, 30 Cents.

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SOME PAGES FROM OUR FIRST ISSUE

INDIA RUBBER WORLD AND ELECTRICAL TRADES REVIEW

Published on the 15th of each Month by

THE INDIA RUBBER PUBLISHING CO.

No. 114 TRIBUNE BUILDING, NEW YORK.

P. F. MOTTELAY, Editor.

Vol 1 OCTOBER 15th, 1889 No. 1

Subscriptions: $2.00 per year: $1.00 for six months, in advance, postpaid, for the United States and Canada. Foreign countries, $2.50; 10 shillings; 12 francs 10 marks; 13 lire or pesetas; 8 florins; postpaid. Special Rates for Clubs of five, ten or more subscribers.

Advertising: Rates of Advertising will be made known on application.

Remittances: Should always be made by bank draft, Post Office Orders, or Express Money orders on New York, payable to THE INDIA RUBBER PUBLISHING COMPANY.

Contributions: Of a technical nature suited to the purposes of this paper, will be liberally paid for if accepted. Correspondence relating to Rubber, Gutta Percha, Celluloid, Asbestos, etc., or any of their practical applications, is cordially invited, and the co-operation of all who make a study of these specialties either a pleasure or a duty is earnestly desired. All communications must bear the name of the writer solely as a guarantee of good faith.

Catalogues: Price Lists; Circulars; Reports of Meetings; early notices of changes in firms or corporations; views of factories, for office display; news items, particularly relating to new specialties; and local newspaper clippings (with endorsement of name and date of paper taken from), will be cheerfully received and fully acknowledged.

Trade supplied by the American News Co. and all its branches.

Entered at New York Post Office as second class matter.

Announcement.

THE extent and growing importance of the caoutchouc industry in the United States, and the fact that it is without representation in technical or trade journalism, are the reasons which have prompted this enterprise; and the character of the demand for such a publication is shown not only in the generous use which manufacturers make of our advertising pages, but in the more significant fact that up to this time the number of our subscribers is limited only by the number of those who have learned definitely that such a paper is to be published in their interest.

The initial plan laid out in these columns, and still to be improved upon as occasion and space offer, shows the result of a careful survey of the field by a corps of editors alike capable and devoted to the interests of the new enterprise. It aims to embrace all procurable information regarding the uses of india rubber and gutta percha in the arts and manufactures, and it will likewise treat fully of the recent very extended applications of the same to all branches of the electrical trades.

We propose to aid materially the scientific and the mechanical development of business in india rubber, gutta percha, and kindred products, by giving the manufacturer all meritorious information procurable as to old and new methods and compounds. Experience gained at different mills, and knowledge acquired directly and indirectly as to the workings of factories here and elsewhere, proves false the generally accepted belief and oft-vented statement that all rubber manufacturing channels are still guarded by really valuable and permanent secret processes. The trade has, in fact, of late years, through the keenness of competition in nearly all departments, made too rapid strides to admit of lasting, important secret changes in any one branch, and, in this respect, the rubber industry is like many others equally progressive.

As has been shown, more particularly by Chandler, Blossom, Bolas and Grimshaw, comparatively little is yet known of the chemical constitution of caoutchouc as well as of its very many possible chemical combinations, and, this being the case, we shall take pains to add in every way to the store of the rubber worker by obtaining and detailing the result of practical experimentation according to satisfactory formulas and desirable patented processes.

Besides keeping pace with new inventions, we shall gradually publish all claims attaching to patents of india rubber and to its sub classes heretofore granted in the United States and Canada, as well as in France, Belgium, Germany and Great Britain.

For the especial benefit of the jobber and retailer, every effort will be made to secure the prompt transmission to us of all particulars of new goods introduced in the market from month to month. These novelties, whether in the mechanical, electrical, druggists' sundries, dress goods, fancy goods, toy, or any other line, are to be fully described, in the department entitled "New Goods in the Market," and will be accompanied by illustrations whenever practicable, as well as by exact or approximate wholesale and retail prices.

Our circulation will reach not only the manufacturers and dealers to whom we cater specially, but it will cover a wide field in other directions, in that every number will contain information which is indispensable to the intelligent purchase of rubber goods by wholesale druggists, wholesale boot and shoe and clothing dealers, stationers, jobbers in hardware, dry goods and notions, and dealers in sporting paraphernalia; while for the benefit of manufacturers and purchasers of electrical appliances, and for electrical people generally, we will devote our attention specially to that important branch of electrical development which has been most neglected and most needs improvement, namely, the intelligent and progressive *mechanical* adaptation of electricity.

Upon one point we are anxious there should be no misunderstanding whatsoever: The reading and editorial pages of this paper are not for sale. Advertisements will appear only in the departments that are avowedly devoted thereto, and whatever is a paid announcement will always honestly be put before our readers as such.

We will add, finally, that we are independent in the fullest sense of the word, and shall continue to be so, favoring no one either directly or indirectly. This will the more readily be done since we have neither hobbies to ride nor pet schemes to advance. Our low rates for subscription and for advertising should bring us liberal patronage, and, through our prospectus, we earnestly invite correspondence as well as the interchange of views from manufacturers, scientists, and all others interested in the scope and success of this publication.

Application of India Rubber to Horse-Cars and Motors.

A RECENT visit to the very extensive establishment of The John Stephenson Co., Limited, in this city, satisfies us that caoutchouc enters for a much larger share in the construction of cars and motors, for both elevated and surface tramways, than is realized by many of our readers. Since Mr. Stephenson made the first horse cars in 1831, fifty-eight years ago, many, of course, have been the changes wrought in their construction, but in no channel have the various applications proven to be of such moment or been so numerous, relatively, as in the line of india rubber.

Entering into the construction of the ordinary horse-car we find :

1st.—Rubber super springs, placed between the sill and pedestal, in order to insulate the body of the car from the running gear

2d.—Rubber packings, mats, etc.

3d.—Rubber springs, which carry the journal box and give an easy motion to the car.

4th.—Rubber hose (life-guards), placed upon shank of journal-box, to throw from the track all obstructions likely to come in front of the wheels.

5th.—Rubber channels, inserted beneath and around the glass wherever metal sash-stiles are used, for the purpose of lessening noise and preventing possible damage to the glass.

6th.—Rubber insulators, attached to the lower part of the car-body, in order to lessen the strain put upon the brakes.

7th.—Rubber drop strips, placed under glass sashes, to diminish noise and possibility of breakage.

8th.—Rubber cushions, for doors and bumpers.

9th.—Rubber balls, fastened to bottom of windlass, so as to prevent chain running off and to protect horses from injury.

10th.—Rubber cones, inserted at top and bottom of springs, to offset any excessive pressure put upon the latter.

In electric motors, such as the above-named company have already constructed, notably for the Julien system in this city, the South Side Electric Line of Cleveland and the Salt Lake City Electric Railway, the super springs are sometimes replaced by a rubber cushion inserted in the eye of the wheel, between the hub and web. This cushion has the merit of preventing the springing of axles, thus keeping them perfectly straight and maintaining the wheels strictly true to gauge, and it likewise avoids the crystalization of the axles and motors.

Applications under the 2d, 5th, 6th, 7th, 8th and 10th headings also attach to motors, which, in addition, carry rubber battery cells and all the India rubber and gutta percha appliances connected therewith. The cells are made of strong though comparatively light, hard rubber, and possess the advantage over other cells of being less fragile, readily handled, and more easily connected in series. They also have acid-proof combs, made of soft rubber, so constructed as to maintain an even space along the entire surface of the plates.

Thus does Daniel Webster's *elastic metal* now successfully replace the doubtfully tempered springs and other attachments of former days, especially where important bearings are subjected to the excessive strain incident to hilly localities, and where heat forces them to what might be called an inordinate degree of expansion, for, unlike iron, steel or brass, vulcanized rubber will stand all climatic changes, being in nowise affected by any extremes of temperature.

—The printing of newspapers by means of electricity has been inaugurated in England by the *East Anglian Daily Times*, of Ipswich, printing its evening edition, the *Star*. The electric power was supplied from accumulators at the central lighting station and the experiment was thoroughly successful. The turning on of a switch provides power day or night, rendering the issue of frequent editions easy.—*London edition of the Herald.*

What Becomes of Old Shoes.

"Old clo" and "old shoe" merchants never pass an ash can without inspecting for old shoes. If any is found it soon finds a hiding-place in the capacious bag carried for the purpose. Each day's labor is taken to the home of the "old shoe man," where it is sorted over. Shoes that are not past a few days of usefulness go under the resuscitating care of an Italian cobbler. He gives the old shoe a new lease of life by endowing it with a new sole and other repairs. These go to some second-hand shoe store, of which there are a goodly number in this city.

The shoes that are past repair are taken to the old junk dealers, who in turn ship them to the shoddy factories. There they are pulled to pieces in order to remove the steel shank piece, if there be any, and then ground to a fine dust. This leather dust is then mixed with about forty per cent. of rubber, which has been gathered in the same way. The mixture of rubber and leather dust is spread in sheets about two feet square and subjected to a pressure of 6,000 to 10,000 pounds per square foot. The substance is then colored, and sold at prices some fifty per cent. below that of leather.

This manufactured leather is used by the manufacturers of cheap shoes, mostly for inner soles. As it is wholly wanting in fibre, it is manifestly a very poor substitute. Shoes with these shoddy inner soles are to be found in large quantities strung on poles and bearing the legend, "All leather, $1."

The industry of making shoddy shoes has greatly improved. At first straw board was used for inner-sole counters, and sometimes for out soles by pasting over with a thin veneer of sole leather. Next leather scraps and old shoes were ground up and mixed with the straw paper. This gave a little better substance. Now shoddy contains leather dust and rubber.—*N. Y. World.*

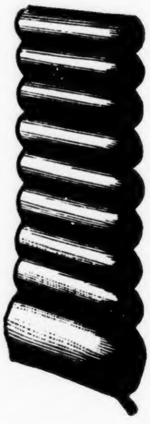
India Rubber Supply.

THE requirements for india rubber being now so large, it is satisfactory to know that the india rubber trade on the Chindwin, in Burmah, although it has only existed for a year, has increased to such an extent that the local government has placed a large export duty on all rubber passing Kendat, the first revenue station on the way to the seaports, besides imposing a license costing ten rupees per annum on all brokers or buyers of the article. According to a recent report rubber is extracted from the *ficus elasticus*, which is similar in appearance to the banyan tree, except that the leaves are larger and of a darker color. Each tree is tapped daily during the season, which extends from November to June, nothing being done during the remainder of the year. In April, 1887, a Chinese syndicate at Bhamo received a monopoly for the extraction of rubber in the Mogoung district. This expired last October, and since then the trade has been thrown open to all. On the Chindwin the trade is in the hands of an English company, which, in spite of vigorous opposition from the Chinese traders, is working satisfactorily, because the natives prefer dealing with the Europeans. All the transport is carried on by native boats down the Chindwin to Kendat, where the rubber is transshipped into steamers. The system of collecting is to send a contractor with a sum of ready money to all the villages in a particular district to make advances to the head men, who, in their turn, send the villagers to the forests to extract the rubber, so that month by month each station has its own stock. This is bought for cash and sent down the river, the head men keeping the advance for further operations.—*Engineering and Mining Journal.*

—A test was recently made on the Raleigh and Gaston Railroad of a new process invented by Baylus Cade for telegraphing to and from moving trains. The current is maintained by means of a drag attached to the car and which slides over a set of wires laid along the track. Messages were received from the offices at Raleigh and Greensboro while the train was running at the rate of thirty miles an hour.

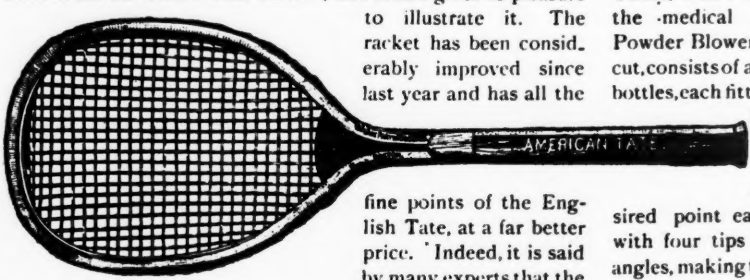
—Just now when the yachting season is commencing the following letter will be of interest: "BOSTON, April 13, 1888. DEAR SIR: We have used your Air Mattresses on our yacht *Gypsey*, for one year. We are much pleased with them. They are well adapted for use on yachts for the reason that they seem to be absolutely impervious to moisture. We think they make a su-

perior cushion, better than one made from hair or any other material that we know of. The Life Saving Collars we use for cushions on deck. They are useful in that way, and seem to be perfectly adapted to the purpose for which they are made. Respectfully yours, UPHAM & PROCTOR." It is but just to say of these mattresses that afloat or ashore, they are the acme of

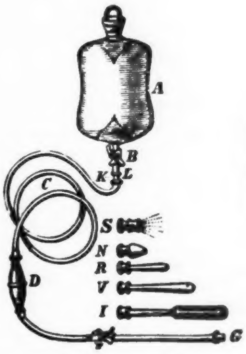


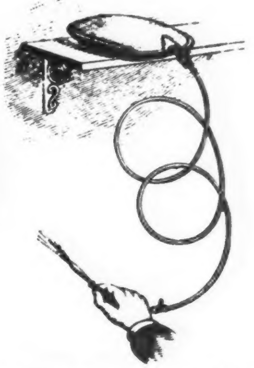
comfort. Few know what genuine rest is until they have tried them. We are aware that this is strong praise, but we honestly believe that the goods deserve it. Other features of these goods were described in the INDIA RUBBER WORLD for April. Manufactured by the World's Air Mattress Company, No. 99½ Summer Street, Boston, Mass.

—In the April number of the INDIA RUBBER WORLD, we described the American Tate Racket, and it now gives us pleasure to illustrate it. The racket has been considerably improved since last year and has all the fine points of the English Tate, at a far better price. Indeed, it is said by many experts that the American Tate is ahead of its English cousin. Manufactured by Horace Partridge & Co., Boston, Mass.



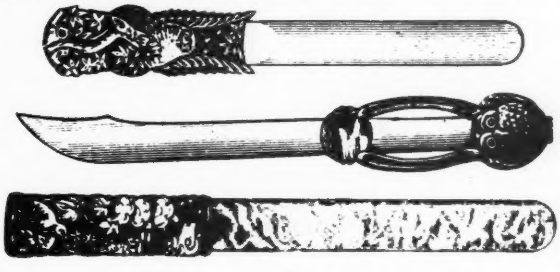
-Mattson's Combination Fountain Syringe is fully illustrated in the accompanying cuts. The small cut shows the bag detached from the syringe, to be used as a water bottle. The neck and stopper are made of hard rubber, rendering them light and durable, so that they do not burn the hands, like brass or metal. The bag may be filled through the nozzle with a pitcher or from the faucet; the improved mode of filling the bag siphonically





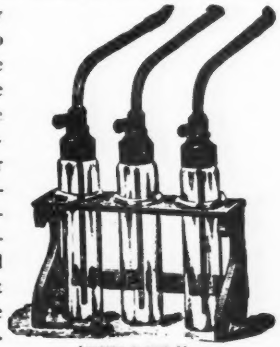
through the tubing is considered a great convenience. After the bag is filled it may be carried to any part of the house for use, as there is no danger of spilling the contents. The bag may be hung from a peg, or placed on a mantel or shelf, or may be laid in a chair, and used by hand-pressure. Manufactured by the Atlas Rubber Company, No. 68 Park Place, New York City.

—Anything that can equal in delicacy and beauty the celluloid paper knives here illustrated would be difficult to find. The blades, made of celluloid, resemble the most beautiful effects in



ivory, horn and tortoise-shell. The handles are of metal; being silver, gold or composition, according to price. Made by the Celluloid Novelty Company, New York City.

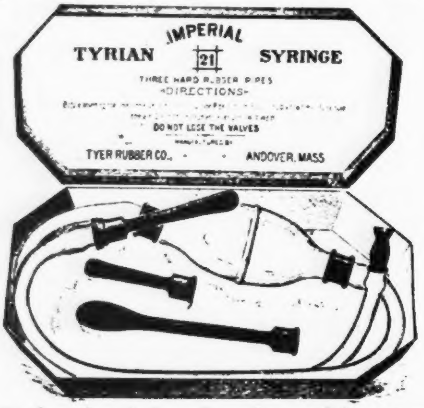
—The Davidson Powder Blower, No. 195, is designed especially for office use by physicians, and is intended to be used in connection with the No. 65 Spray Tubes, which are well known to the medical profession. The Powder Blower, as shown by the cut, consists of a rack holding three bottles, each fitted with a hard rubber tube, and for convenience in directing the powder to the desired point each tube is fitted with four tips bent at different angles, making the most complete instrument of the kind ever offered to the profession. The instrument is designed for use with the Sass Condenser, but it works equally well with an ordinary hand bulb. Manufactured by the Davidson Rubber Co., Boston, Mass.



DAVIDSON RUBBER CO.

—A novelty that commends itself almost immediately to the popular judgment, is a stirrup plate of flexible rubber. It is so arranged with clasps, that it may be attached to any stirrup; while its nickel-plated copper straps, and neatly corrugated surface, make it an attractive addition. Made either square or oval, and finished with the utmost care. Manufactured by the U. S. Rubber Works, Brooklyn, N. Y.

—A new and popular syringe has lately been brought out by the Tyer Rubber Company of Andover, Mass., under the name of the Tyrian Imperial Syringe, No. 21. Its main excellence is



perhaps the fact that it is a first class article at a moderate price. It is furnished with hard rubber valve boxes, three hard rubber pipes, an extra heavy bulb and excellent tubing, and is put up in an attractive octagonal box.

—The manufacture of articles embraced in the line of Mechanical Goods has become quite an important feature with the Metropolitan Rubber Company, whose extensive salesrooms are at 649 and 651 Broadway (near Bleecker Street), New York. Conspicuous in that line are pure moulded royal handhole and manhole gaskets, and plain and corrugated tubing. The former is a soft, pliable article, constructed with a view of closely fitting rough or uneven plates, as well as smooth, thereby preventing the frequent "blowing out," common to the hard gasket; while the latter is of a quality that precludes the possibility of a customer's liability to soliloquize: Tubing, or not tubing.

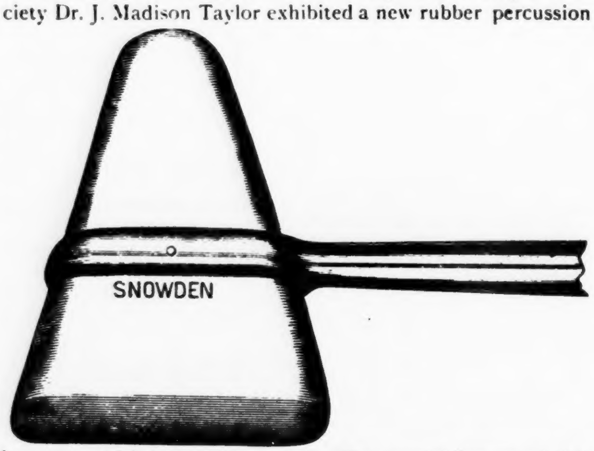
—The accompanying illustration gives a combination view of some of the latest patterns of Mackintoshes offered by the Metropolitan Rubber Company, New York. For years past the officers of this Company have labored diligently to produce and place before the public a garment at once stylish, serviceable, reasonable in price and thoroughly waterproof. That their efforts have been rewarded is made apparent by the large addition to their plant, noted elsewhere. Perceiving growing interest in Mackintosh goods by the tradespeople at large, they have moved rapidly yet cautiously

forward until now they carry in stock fully 175 different styles of men's and women's garments, so graded in price that they come within the reach of the person of moderate income as well as the man of admitted wealth. All-wool goods of permanent color are chiefly employed in the manufacture of these goods, though silk has, of late, held quite a conspicuous place among their garments designed for ladies' wear. Many beautiful specimens may be seen at their salesrooms, and merchants dealing in this line of goods may be sure of obtaining at their headquarters, 649 and 651 Broadway, an article which will satisfy the most exacting and fastidious of their customers.

—The Lycoming Rubber Company have brought out a little arrangement which will be in favor with all ladies who wear rubber shoes. It is simply a ribbon from the heel of a shoe to the button on the boot, over which a little loop slips. With this fastening it is next to impossible for even Jersey mud to pull off a rubber. The name that this Company has given this attachment is the "Hold-fast." We predict for it much popularity.

—Lightness in weight in Dental Rubber is something that is desired by both the dentist and the customer. This has been attained to a remarkable degree by the Excelsior Rubber Works, Dr. H. Traun, proprietor, whose New York office is at 335 Broadway. The new Dental Gum that they are now furnishing to the trade is, in color, a beautiful light maroon, and is forty per cent. lighter in weight than any other on the market. While other dental rubbers are sold seventeen sheets to the pound, this runs twenty-four sheets to the pound. It is also, by actual test, the strongest compound that can possibly be made.

—At a recent meeting of the Philadelphia Neurological Society Dr. J. Madison Taylor exhibited a new rubber percussion



hammer, which is here illustrated. The special feature of this hammer is that the shape of the striking surface is like the outer aspect of the extended hand, palm downward, which is most often used in obtaining tendon jerk. The rounded apex end is adapted to reach the biceps tendon at the bend of the arm.

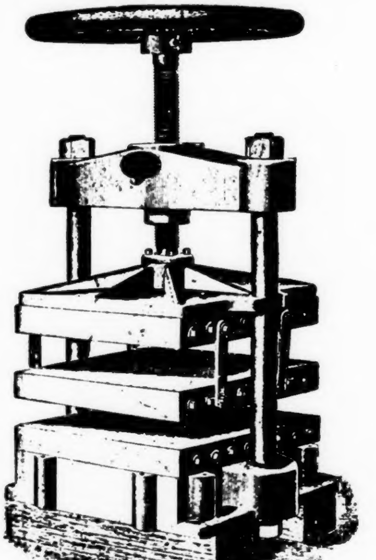
U. S. IMPORTS, EXPORTS AND RE-EXPORTS.

For the MONTH, and the SEVEN MONTHS ending JULY 31, 1889, compared with the corresponding periods of 1888. OFFICIAL.

ARTICLES.	QUANTITIES.				VALUE IN DOLLARS.			
	MONTH ending JULY 31—		SEVEN MONTHS ending JULY 31—		MONTH ending JULY 31—		SEVEN MONTHS ending JULY 31—	
	1889.	1888.	1889.	1888.	1889.	1888.	1889.	1888.
IMPORTS.								
FREE OF DUTY.								
India rubber and gutta percha, crude.......lbs..	2,064,563	1,976,988	19,491,753	21,548,706	725,243	797,545	7,328,754	9,242,283
DUTIABLE.								
India rubber and gutta percha, manufactures of..	....	....	....	....	30,274	25,610	204,593	230,250
EXPORTS.								
India rubber and gutta percha, manufactures of..								
Boots and shoes.............. ....pairs..	28,246	2,947	61,144	27,977	28,110	4,231	62 634	37,040
All other.....................	....	....	.. ..	....	68,700	61,614	446,247	442,254
RE-EXPORTS.								
India rubber and gutta percha, crude.......lbs..	48,091	60,452	142,314	349,904	18,120	26,967	57,401	168,087
India rubber and gutta percha, manufactures of..	....	....	....	.. ..	....	.. ..	1,984	212

Clark's Rubber Press.

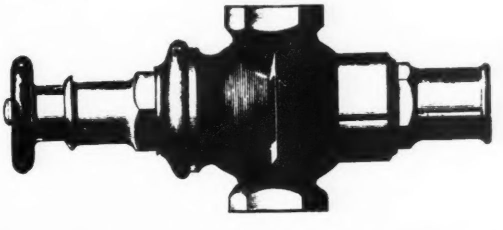
THE accompanying illustration is an exact representation of the improved rubber press manufactured by Edred W. Clark, Hartford, Conn. It was introduced some years ago, but has lately been much improved, and it has won staunch advocates of its merits in many rubber works where it is in use



The machine is made of excellent material throughout, the screws being of the best refined steel with extra long composition nuts, and the steam plates are so cored that crushing them is impossible in the use of small moulds. The hand wheel is so placed on the screw as to treble the lever power of the old style press, and the pressure is limited only by the breaking strain of metal. They are made in six sizes ranging from 24x30 to 10x10. Mr. Clark also makes a specialty of rubber moulds and elsewhere, in our advertising columns, he gives an excellent illustration of a tubing machine which is winning high encomiums from those who have seen it in continuous work.

The Heater Man's Relief.

IN the old-fashioned rubber factory, after a "heat" was "up," the greatest care was taken to keep the steam just at the proper notch, and not allow it to run either up or down until the vulcanization was finished. For this purpose a "heater man" was constantly opening and shutting the valves and even then failing to



keep up an even pressure. Through the courtesy of the Mason Regulator Co., of Boston, we append a cut of a simple contrivance, the "Mason Reducing Valve," which does away with all anxiety about evenness of pressure, and keeps the "heat" up to any point desired without possibility of variation. These valves are already in use in many of the larger rubber factories, and are found most valuable, not only on vulcanizers, but on presses, pumps, shoe heaters, etc. In the neat pamphlet entitled "Steam Regulating Specialties," which this company publish, we notice a warm testimonial to the efficacy of the Mason Regulator, from Engineer J. F. Mayall, of the American Rubber Company, Cambridge, Mass.

POISONOUS METALLIC CONTAMINATION OF INDIA RUBBER GOODS.—The india rubber tubing, stopples, infants' nursing bottle fittings, etc., of our market I have found to contain large quantities of zinc, which is a metallic poison. The use of zinc oxide, etc., in these goods is prohibited by law in Europe, just as is the use of lead oxide. That nursing-bottle tubing, nipples, teething-rings, etc., may stand in some relation to certain infantile diseases seems plausible. India rubber tubes are often used for siphoning wines, ciders and other beverages which might thus become polluted with zinc. It is noteworthy that in my examinations of india rubber goods I have never yet discovered lead; zinc oxide, *per se*, is not, perhaps, a poison. But, let it meet an acid, a poisonous zinc salt will result.—*Drug Circular.*

QUOTATIONS

FOR PIGMENTS, SOLVENTS, ETC., EMPLOYED IN THE INDIA RUBBER AND GUTTA PERCHA INDUSTRIES.

NOTE.—Every article herein named has been used in compounds for India Rubber and Gutta Percha. The accompanying quotations have been especially prepared and will be duly revised exclusively for THE INDIA RUBBER WORLD, and they represent current prices for average small orders. The publishers will be pleased to put buyers into communication with manufacturers of any of the articles quoted and no charge whatsoever, directly or indirectly, will be made for that service to either party.

Acetone, b. p. 57° c	per lb.	$1 50
Acid, Abietic	per gm.	2 00
" Acetic	per lb.	0 28
" Benzoic, Germ	per lb.	0 65
" Boracic	per lb.	0 26
" Carbolic, Com	per lb.	0 60
" Cholalic	per lb.	0 42
" Chromic	per oz.	0 11
" Formic	per lb.	1 00
" Gallic	per lb.	1 30
" Hydrochloric	per lb.	0 23
" Nitric, 38°	per lb.	0 40
" Oleic, pure	per lb.	0 40
" Oxalic	per lb.	0 50
" Phosphoric	per lb.	0 50
" Silicic	per lb.	0 75
" Sulphuric	per lb.	0 15
" Tannic	per oz.	0 30
" Tungstic	per lb.	0 40
Actinium, Sulphide		
Alabaster Dust	per ton,	18 00
Albuminous Substances. *See* Casein, etc.		
Alcohol, Wood	per gal.	1 45
Alkalies, *See* Ammonia, etc.		
Alkanet, Root, powd	per lb.	0 22
" (Anchusin) paste	per lb.	6 50
Alum, lump	per lb.	0 03
" powdered	per lb.	0 06
Alumina, Sulphate	per lb.	1 00
Aluminium, Abietate		
" Acetate	per lb.	0 50
" Sulphate	per lb.	0 75
Alum. Earth, *Bauxite*	per ton,	8 00
" " Corundum	per lb.	
Ammonia. *See* Spirit.		
Ammonium, Bichromate	per lb.	1 20
" Carbonate	per lb.	0 09
" Chloride	per lb.	0 40
" Chlor. powd	per lb.	0 18
Aniline, Salt	per lb.	0 60
Anthracene	per oz.	0 12
Antimony, Sulph. black	per lb.	0 10
" " golden	per lb.	0 40
" (Kermes) Sulph. red	per lb.	1 25
Arrow Root, Jamaica	per lb.	0 20
Arsenic, Red Sulph. (Realgar)	per lb.	0 10
" Yel. " (Orpiment)	per lb.	0 15
Asbestine	per ton,	$20 @ 22 00
Asbestos, powdered, No. 3	per lb.	0 05
" short fibre. No. 3	per lb.	0 08
Asphaltum, *See* Gum.		
Assafœtida, *See* Gum.		
Azo-Benzol, Merck	per oz.	1 25
Balsam, Canada	per gal.	3 25
" Styrax	per lb.	0 30
" Sulphur	per lb.	0 40
Barium, Peroxide	per lb.	1 00
" Sulphate	per lb.	0 06
Benzol, Coal Tar	per lb.	1 00
Bismuth, *See* Glance.		
Bitumen, *See* Pitch, Mineral.		
Black Pigment, dry	per lb.	0 12
Bleaching Powd. *See* Lime Chlor.		
Blue Pigment	per lb.	0 30
" Ultramarine	per lb.	0 15
Bole, powdered	per lb.	0 12
Bone, Black, *See* Charcoal.		
" Dust, by bbl	per lb.	0 02
Borax, lump, by bbl	per lb.	0 08
" powdered	per lb.	0 09
Boron (Borium), crys	per gram.	4 00
Brimstone, *See* Sulphur Rolls.		
Bromine, Chloride	per oz	0 75
Brown Pigment, dry	per lb.	0 04
Cadmium Sulphide	per oz.	0 50
Calcium Chloride	per lb.	0 40
" Sulphide	per lb.	0 42
Calomel	per lb.	0 80
Camphene, *See* Turpentine.		
Camphor, *See* Gum and Oil.		
Caoutchoucene		
Carbon Bisulphate	per lb.	0 15
" Bisulphide	per lb.	0 11
" " highly rect'd	per lb.	0 20
" Trichloride, liq	per oz.	0 75
" " crys	per oz.	1 20
Casein (Caseum)	per lb.	0 80
Catechu, *See* Gum.		
Cerezin, *See* Wax Min.		
Chalk, Carbonate, Am	per lb.	0 09
" Precip., Engl	per lb.	0 08
" French, powd	per lb.	0 04
Charcoal, Anim. purif	per lb.	0 06
" Anim. powd	per lb.	0 03
" Fine Willow	per lb.	0 12
Chlorine Water	per lb.	0 22
Chloroform, Purified	per lb.	0 50
Chrome *See* Lead and Zinc Chromates.		
Chromium, Oxide	per oz.	$0 30
Cinnabar, *See* Mercury.		
Clay, China (Kaolin)	per lb.	0 05
" Pipe, powdered	per lb.	0 10
Cocoanut Fibre		
Colcothar, *See* Iron.		
Collodion	per lb.	0 76
Colophony, *See* Resin.		
Copper, Oxide, Black	per lb.	0 90
" " Red	per lb.	1 25
" Sulphate	per lb.	0 05
Cork, granulated	per lb.	0 05
Cutch, Catechu, *See* Gum.		
Creosote, Creasote	per lb.	0 60
Dextrine, all shades	per lb.	0 09
Emery Cloth, all Nos	per rm.	7 25
" Powder, by keg	per lb.	0 03
Ethyliden, Chloride	per oz.	1 00
Ether, Acetic	per lb.	0 65
Eupione, Mercks'	per gm.	0 35
Extract Cochineal	per lb.	1 25
" Indigo, best	per lb.	0 60
" " ord	per lb.	0 09
" Lake Liquor		
" Logwood	per pt.	0 60
" Mulberry, Fig.	per lb.	0 50
Farina	per lb.	0 07
Feldspar, powdered	per lb.	0 10
Fibres, *See* Cocoanut, etc.		
Fibrin, Mercks', blood	per gm.	0 20
" " plants	per gm.	0 25
Flint Dust, by bbl.	per lb.	1 20
Formyle, *See* Acid Formic.		
Fuller's Earth, powd	per lb.	0 08
Galena, *See* Lead Sulphide.		
Gelatine, Cooper's sheet	per lb.	0 85
" French white	per lb.	0 80
Glance Bismuth	per oz.	0 60
" Copper	per lb.	1 00
" Silver	per oz.	3 00
Glass Liquid	per lb.	0 05
" Powdered	per lb.	0 08
Glue, Cooper's A, Ex	per lb.	0 24
" Isinglass, Am	per lb.	0 85
Gluten, Vegetable	per oz	2 25
Glycerine	per lb.	0 25
Gold, Chloride and Sodium	per oz.	6 12
" Oxide	per oz.	24 50
Granite, Marble Dust	per bbl.	1 10
Graphite, purified	per lb.	0 75
Green Pigment, dry	per lb.	0 20
Gum Arabic	per lb.	0 90
" Asphaltum	per lb.	0 10
" Assafœtida	per lb.	0 15
" Benzoin	per lb.	0 60
" Camphor	per lb.	0 40
" Catechu	per lb.	0 25
" Copal	per lb.	0 30
" Damar	per lb.	0 25
" Elemi	per lb.	0 25
" Euphorbium	per lb.	0 20
" Gamboge	per lb.	0 65
" Juniper	per lb.	0 40
" Kowrie	per lb.	0 40
" Mastic, powd	per lb.	1 15
" Sandarach	per lb.	0 40
" Sanguis Draconis	per lb.	0 35
" Shellac, native	per lb.	0 23
" " bleached	per lb.	0 16
" *See* also Balsam, Resin.		
Gutta Percha Solution, *See* Traumaticin.		
Gypsum, *See* Alabaster, etc.		
Hemp Fibre	per lb.	0 14
Honey, Strained	per lb.	0 12
Horn Dust, Shavings	per lb.	0 06
Infusorial Earth, domestic	per lb.	0 06
" " foreign	per lb.	0 08
Ink, India	per lb.	2 00
Iodine, Chloride	per oz.	0 70
" Resublimed	per lb.	4 00
Iron, Carburet, *See* Graphite.		
" Carbonate	per lb.	0 32
" Filings of	per lb.	0 10
" Oxide, black	per lb.	0 40
" " red (Colcothar)	per lb.	0 12
" Sesquichloride	per lb.	0 60
" Sulphide	per lb.	0 15
" Tungstate (Wolfram)	per lb.	0 30
Isinglass, *See* Glue.		
Ivory Black, *See* Charcoal.		
Jute Fibre	per lb.	0 05
Kermes, *See* Antimony.		
Lamp Black, B. & S	per lb.	0 06
" " Eddy	per lb.	0 20
" " Germ	per lb.	0 10
Lead, Abietate		
" Acetate (Sugar of Lead)	per lb.	$0 13
" Black, Am	per lb.	0 04
" Carbonate (Wh. L.)	per lb.	0 06
" " (Fl. White)	per lb.	0 15
" Chromate, powd	per lb.	1 10
" Hyposulphite (Thiosulphate)	"	0 70
" Oxides, *See* Litharge, etc.		
" Peroxide (Puce)	per lb.	0 60
" Sulphate	per lb.	0 40
" Sulphide	per lb.	1 35
" Tannate	per oz.	0 30
Leather, Sole, powd	per ton	11 00
Licorice, Calabria	per lb.	0 50
" American	per lb.	0 16
Lignine, *See* Fibrin, etc.		
Lime, Carbonate, *See* Chalk.		
" Caustic	per lb.	0 50
" Chlorinated	per lb.	0 63
" Phosphate	per lb.	0 25
" Spec. Prep	per lb.	0 03
Litharge, American	per lb.	0 06
" Foreign	per lb.	0 12
Magnesia, Carb., powd	per lb.	0 35
" Oxide	per lb.	0 30
" Silic., *See* Chalk. Fr.		
Manganese, Black Ox	per lb.	0 40
" and Iron, Chl	per lb.	0 30
Mass, *See* Iron Carbonate.		
Mercury, Bi-cyanide	per oz.	0 40
" Bi sulph. (Cinnabar)	per lb.	1 30
" Ferro cyanide	per oz.	1 50
" Red Oxide	per lb.	1 60
" Sub-chloride, *See* Calomel.		
" Sulph., *See* Vermilion.		
" " Black	per lb.	0 80
" Sulpho-cyanide	per oz.	0 30
" with Magnesia	per lb.	1 15
Methylene, Chloride	per oz.	0 60
Mica, ground, med	per lb.	0 10
Mineral Wool	per ton.	20 00
Minium	per lb.	0 06
Musk, Chinese	per oz.	0 45
Naphtha, Wood	per lb.	0 35
Naphthalene, Wht, Resublimed	per lb.	0 25
Naphthol, White	per lb.	1 50
Nickel, Sulphate, Ammoniated	per lb.	0 75
Nitro-benzol	per lb.	0 60
Oil, Camphor	per lb.	0 30
" Caraway	per lb.	1 10
" Castor, Am	per lb.	0 12
" Cocoanut	per lb.	0 10
" Colza	per gal.	0 62
" Cottonseed, Y. W	per gal.	0 60
" Dippel's (Bone)	per oz	0 30
" Eucal, Glob	per lb.	2 00
" Linseed, boiled	per gal.	0 55
" " raw	per gal.	0 50
" Musk	per oz.	0 75
" Neatsfoot	per gal.	0 75
" Palm	per lb.	0 06
" Paraffin	per gal.	0 20
" Peanut	per gal.	1 40
" Rapeseed	per gal.	0 64
" Resin, rect	per lb.	0 45
" Tar, Birch	per gal.	0 30
" Tar, Lignite	per lb.	1 00
" Thyme, White	per lb.	1 00
" Turpentine	per lb.	0 35
" Vitriol. *See* Ac. Sulph.		
" Walnut	per lb.	0 40
Orpiment, *See* Arsenic.		
Orris Root, powd	per lb.	0 16
Oyster Shells, ground	per lb.	0 15
Ozokerite	per lb.	0 25
Paper, Flint, Sand	per rm.	4 25
" Nat., Emery	per rm.	6 25
" Pulp	per lb.	0 04
Paraffin, *See* Oil, Wax.		
Paranaphthaline, *See* Anthracene.		
Paris, White, by bbl	per lb.	0 01
Pearlash, *See* Pot. Carb.		
Petroleum, Am. Med	per gal.	0 09
" Ether	per pt.	0 40
Phosphorus	per oz.	0 50
Pigments, *See* Blue, etc.		
Pinol, L. & F.	per lb.	6 00
Pitch, Black, by bbl	per lb.	0 04
" Auvergne		
" Burgundy	per lb.	0 06
" Egyptian	per lb.	0 09
" Mineral	per lb.	0 15
" Trinidad	per ton.	35 00
Plaster Paris	per bbl.	1 50
Plumbago, *See* Lead, Black.		
Potash	per lb.	0 06
Potassa, Caustic, com	per lb.	0 50
" " and Lime	per lb.	0 70
Potassium, Arseniate	per oz.	0 10
" Bichromate	per lb.	0 12
" Carbonate	per lb.	0 08
" Nitrate	per lb.	0 13
" Sulphide	per lb.	0 22
Pumice Stone, *See* Stone.		
Prussian Blue	per lb.	0 20
Pyroxylin, spec. prep	per oz.	0 35
Realgar, *See* Arsenic.		
Red Pigment, super	per lb.	0 09
Resin, *See* also Gum.		
" Dark (Colophony)	per lb.	0 06
" White	per lb.	0 04
" Yellow	per lb.	0 03
Rhigolene, *See* Pet. Ether.		
Salt, *See* Sod. Chloride.		
Sand, Fine, White	per bbl.	1 50
Sawdust, v. fine	per bbl.	0 25
Sea Weed, Tang	per lb.	0 90
Selenite, powd	per oz.	0 15
Selenium	per oz.	3 00
Sienna, burnt and powd	per lb.	0 02
Silica, *See* Ac. Silicic.		
Silver, Metallics	per lb.	1 30
Slate, pulverized	per bbl.	0 70
Soap, Castile, White	per lb.	0 12
" Olive, Soda	per lb.	
Soap Stone (Steatite)	per lb.	0 05
Soda Ash (Bicarb.)	per lb.	0 02
" Caustic	per lb.	0 03
Sodium, Bi-borate	per lb.	0 80
" Bi-chromate	per lb.	0 25
" Chloride	per lb.	0 30
" Hydrosulphide	per lb.	0 70
" Metallic	per oz.	0 35
" Nitrate	per lb.	0 14
" Silicate, *See* Glass Liq.		
" Sulphate	per lb.	0 20
" Tungstate	per oz.	0 09
Spar, *See* Barium Sulph.		
Spirits, Ammonia	per lb.	0 47
" Camphor	per lb.	0 50
" Turpentine	per gal.	0 45
Sponge Cuttings	per lb.	0 15
Starch, Corn, pulv	per lb.	0 00
" Pure, by bbl	per lb.	0 05
Stearine	per lb.	0 17
Steel Filings	per lb.	0 12
Stone, Pumice	per lb.	0 03
" Rotten	per lb.	0 07
Sulphur, Chloride	per lb.	0 80
" Flowers, wash	per lb.	0 07
" Liver, *See* Pot. Sulph.		
" Precip., pure	per lb.	0 11
" Rolls, by bbl	per lb.	0 02
Talc, *See* Chalk, French.		
Tallow	per lb.	0 04
Tannin, *See* Acid Tannic.		
Tapioca, Pearl	per lb.	0 07
Tar, Common	per bbl.	3 00
" Stockholm	per lb.	0 12
Terra Alba	per lb.	0 08
Tin, Bi-chloride	per oz.	0 15
" Bi-sulphide	per oz.	0 25
" Muriate	per lb.	0 40
Toluene, Toluol	per lb.	0 60
Tonka Bean	per lb.	1 60
Tortoise Shell, powd	per lb.	0 05
Traumaticin, Mercks'	per oz.	0 20
Tripoli, Mt. Eagle	per oz.	0 65
Tungsten, Oxide, pure	per oz.	0 40
Turpentine, Chian	per oz.	0 50
" Camphene	per gal.	0 55
" Venice	per lb.	0 19
Umber, burnt and powd	per lb.	0 04
Varnish Settlings	per gal.	0 23
Vegetable Black, spec. prep	per lb.	0 10
Vermilion, American	per lb.	0 18
" English	per lb.	0 60
Vitriol, *See* Copper Sulphate.		
Wax, Carnauba	per lb.	0 16
" Japan	per lb.	0 15
" Mineral	per lb.	0 16
" Paraffin	per lb.	0 05
" White	per lb.	0 45
Whalebone, ground	per lb.	0 25
Whiting, by bbl	per lb.	0 01
Wolfram, *See* Iron.		
Wood Pulp, ground	per lb.	0 02
Yellow Chrome, *See* Lead Chromate.		
" Pigment, dry	per lb.	0 06
Zinc, Abietate		
" Chromate	per oz.	0 25
" Oxide, G. Seal	per lb.	0 08
" " R. Seal	per lb.	0 07
" Sulphate	per lb.	0 07
" Sulphide	per lb.	0 18

Vulcanization Developments in Tires

Ian Patterson[1]

NECESSITY as the Mother of Invention has been evident in many ways during the history of rubber tires. Although the impelling urge back of the discovery of vulcanization was not tires, but other articles then of prime importance, a large number of the improvements to the vulcanization process have followed closely the increasing demand on tires to fulfill a greater service.

Vulcanization of rubber was discovered long before there was a necessity or even a desire for quietness and easy riding qualities in transportation media. The slow speeds of carriages, wagons, and other means of carrying men and materials over uneven surfaces in the first half of the last 100 years did not demand great comfort in travel. Likewise smooth iron rails and good spring suspension sufficed for trains drawn by the relatively fast, yet heavy steam engines.

Half Century after Vulcanization

As related to rubber tires, the first 50 years following Charles Goodyear's discovery of vulcanization in 1839 are of more importance historically than because of any practical developments. The earliest patented pneumatic tire was first laughed at and then forgotten. However Robert W. Thomson's patent for this aerial wheel, which was issued in England in 1845, in France in 1846, and in the United States in 1847, anticipated many other inventions and alleged inventions that were proposed 40 or 50 years later.

Thomas Hancock, after having been given a piece of Charles Goodyear's sulphur and heat-treated rubber, but without information as to the method used in producing it, developed and patented in England a so-called method of vulcanization by immersing rubber into hot liquid sulphur.

Thomson's aerial wheels were vulcanized by Hancock's method. It does not appear that these pneumatic tires went into use except as a curiosity. "It was the size of Thomson's tires, next to the noiselessness of the wheels, that most attracted attention. They were five inches in diameter for a brougham." A set of Thomson's tires was reported as "having been run for 1200 miles without 'the slightest symptoms of deterioration or decay.'"[2]

During the 30 years following Goodyear's discovery of vulcanization solid rubber tires were normally used on wheels attached to vehicles of low carrying capacity. Thomson's accomplishments also included solid rubber tires up to five inches thick for traction engines running on common roads. These were described in leading European scientific journals in 1868.

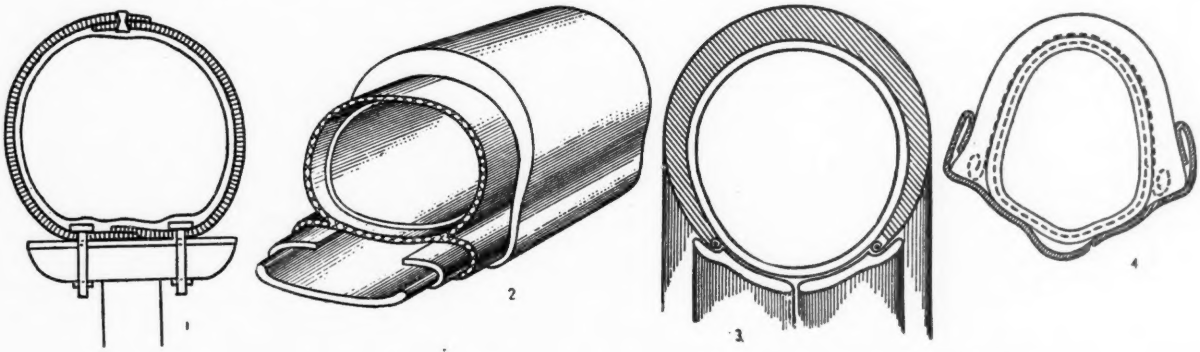
Between the years of 1871 and 1874 many rubber manufacturers in England filed patents on solid rubber tires for bicycles, and other modes of transportation. Owing to the slow speed of the vehicles then in use, there were only a passive interest and certainly no necessity for attaching these tires to the wheel in an ultra-strong and safe manner. With the later introduction of velocipedes, or bicycles having relatively higher speeds, came a demand for and renewed activity in rubber tire manufacture.

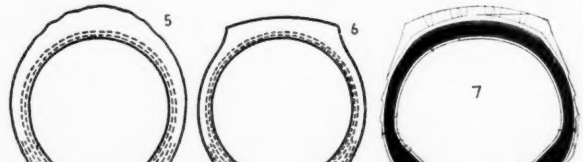
Most Recent 50 Years

In 1888, John Boyd Dunlop patented in Great Britain the type of elastic tire which had the greatest and most far-reaching effect upon the evolution of the bicycle. Although the Dunlop inventions may have been anticipated in Thomson's patent in 1845, the wide usefulness and exploitation of this later period were necessary to make them a dominant force in advancing the use of rubber tires.

The demand of the automobile industry for longer wearing tires to operate at increasingly higher speeds brought the necessity for improvements on Charles Goodyear's original methods. The greatest improvements on his basic process have been perfected during the past 30 years. The raw material used by Charles Goodyear was obtained from wild trees, as first found on the American continent in the days of Columbus. This same wild rubber was the only type commercially available for 65 years

[1] Goodyear Tire & Rubber Co., Akron, O.
[2] "Pneumatic Tires." H. C. Pearson, 1921, pp. 34, 35.





Progress in Pneumatic Tires

1. Pneumatic Tire Made under Thomson Patent (1845); 2. First Dunlop Pneumatic (1888); 3. First Demountable Pneumatic Made by Welch (1890); 4. First Bartlett Clincher Tire (1890); 5. Clincher Tire of 1898; 6. Straight Side Tire (Early Twentieth Century); 7. Truck Bus Tire, 10-ply—9.00/20 (1938)

after Goodyear's discovery, and the native supply had its upper limits. Without the extensive cultivation and propagation of rubber trees which came later, the magnitude and economical utility of the rubber industry, as we know it today, would have been impossible. Thus the first major development affecting the application of vulcanized rubber can be considered to be plantation rubber.

In 1876, Sir Henry Wickham smuggled seeds from rubber trees out of their native Brazil. These seeds were germinated in Kew Gardens, London, and the small trees were set out in Ceylon. From this, the plantation rubber industry grew and was extended to Malaya, Dutch East Indies, and other Far East countries. The first commercial appearance of plantation rubber in the United States was in 1905, but a major portion of the requirements was not available until nearly a decade later. This trend continued, and ample supplies of raw rubber, which have now been available for many years, should continue except when intermittently choked by regulation or transportation difficulties.

The second major development pertaining to vulcanized rubber was the method of reprocessing, or reclaiming, vulcanized rubber so that it could be reused as a base material. Various attempts at reclaiming vulcanized rubber were made during the first 50 years after Goodyear's discovery. Hall's steam-water patent in 1858 and Mitchell's acid process patented in 1881 are instances. The alkali process discovered by Marks in 1899 proved to be the most important economic and practical method for reclaiming vulcanized rubber so that it would be plastic, pliable, and adaptable for remolding. In this process fabric and free sulphur are separated by the action of alkali from their intimate contact with the vulcanized rubber which retains the combined sulphur, after which the foreign matter is washed away. By the addition of softening oils under heat treatment the product, which is rendered workable, is then sheeted out. This, or any other method of reclaiming so far discovered, does not reverse the vulcanization reaction. It simply makes vulcanized rubber plastic and usable again, usually in connection with varying proportions of raw rubber and the appropriate amount of vulcanizing materials. Although other types of reclaim are made, worn tires are today the chief source of raw material for this process.

The demand for an improvement and speeding up of the vulcanization process brought forth the discovery and application of many organic chemicals for use with rubber. These were later termed rubber accelerators. Oenslager's use of aniline and other organic substances in 1906 and later, marked the first major step away from the inorganic type of accelerators originally used in Goodyear's formula. Some years later other scientists such as Sebrell and Bedford brought forth mercapto-benzo-thiazole and other organic chemicals which greatly improved the quality of product and speed of reaction in the vulcanization process.

The introduction of carbon black as a reenforcing agent and wear resister for rubber tire treads by Tew and Oenslager in 1910 and 1912 was another major contributing factor. This step forward, covered by a simple statement of a few words, is of real importance as an advancement in the quality of vulcanized rubber particularly as applied to tires. Carbon black, sulphur, accelerators, and antioxidants are now recognized basic ingredients in rubber tire compounds, helping to make modern high-speed tires long wearing and practical.

Deterioration from age and oxidation of both raw rubber and vulcanized rubber has long been recognized as a limiting factor in the useful life of rubber goods. The first recorded work on oxidation was that of Spiller in 1864. It was not until 1924, however, that a patent was registered in the United States by Winkelmann and Gray covering the use of the chemical, aldol-alpha, naphthylamine, as an age resister or antioxidant. Materials of this type prolong the life of vulcanized articles, including tires, and are now used extensively.

The adhesion of vulcanized rubber to metal has had applications in tires as well as molded and other mechanical goods. Solid tires have made use of this development to a greater extent than have pneumatic tires. Older methods of using a compound with higher sulphur content which was vulcanized to the hard rubber state after application to clean roughened surfaces of metal often depended to a large extent on mechanical grips for the hard rubber. The same might be said of the union of softer vulcanized rubber on to copper or brass plated metal surfaces, but the mixture of molecules from compounds of copper, sulphur, rubber, zinc oxide, and lime is probably more intimate and therefore more effective. The use of cyclized rubber on metal surfaces is an effective modern method of obtaining adhesion.

The direct use of latex on a large scale in the manufacture of tires and other articles came into prominence in 1923 and assumed much greater proportions in later years. The application of the vulcanization process in latex also took place during these years. Ammonia as a preservative for transporting latex over long distances had been known since 1853, but the economic loss in carrying useless water to manufacturing centers had been considered to be too high for practical acceptance. With the introduction of concentrated latex the costs of transportation per pound of dry rubber were reduced. This field is now expanding rapidly, and the possibilities for development in the future are great. Latex is being used for impregnation of fabric in tire manufacture, and increasing advantages from its inherent qualities are continuously being found.

These developments—plantation rubber, reclaim rubber, organic accelerators, carbon black, age resisters, and antioxidants, direct use of latex on a large scale, and the adhesion of rubber to metal are all related to the vulcanization of rubber and to the wider use of vulcanized rubber in tires and other articles. Demands for increased serviceability and economical manufacture of tires have prompted research and have resulted in a rapid advance in the art of producing rubber goods such as are known today.

Equipment for vulcanizing tires and tubes has played an important part in extending Charles Goodyear's process. The wrapping of rubber articles on forms or mandrels with fabric for vulcanizing in autoclaves is one of the earliest methods. Heating bolted molds in autoclaves has been the practice for many years and, although still in use to some extent, is rapidly being replaced.

The presses patented by Moomy and Doughty in 1896 applied pressure in a positive manner, reducing the time of cure and the occurrence of porous vulcanized material. In the curing or vulcanizing of tires a real advancement was made when internal pressure was obtained by means of gas or liquid, heated or cold, in place of an iron core inside the tire.

In the 100 years since vulcanization was discovered, it can be noted that most major improvements to this basic process have developed during the last half century, with considerable concentration in the most recent 30 years. This is the period when the demand for tires has been the greatest. The advancements made in both the process and the product have been coordinated to produce the remarkable service and satisfaction which is now enjoyed.

History of the Division of Rubber Chemistry of the American Chemical Society

Thirty Years of Progress in Cooperative Effort to Extend the Knowledge of Rubber . . .

E. V. Osberg

AFTER long years of experience the rubber industry of today has come to realize the true worth of the chemist and the value of the interchange of scientific knowledge and cooperation in research. Early meetings and discussions held by the Division of Rubber Chemistry, American Chemical Society, and its predecessor, the Rubber Section, were influential in dispelling the early ideas as to the value of the chemist and in breaking down the barrier of secrecy in the rubber trade. The chemistry of rubber during the past two decades has undergone a tremendous growth, and the Rubber Division through its many activities has played an important role in disseminating the knowledge that has been gained from laboratory research.

The Early Rubber Chemist

Before the turn of the twentieth century the rubber industry had little or no knowledge of the chemist or what he might accomplish. Funds for research were generally withheld, with no quick profits in sight as a result of these expenditures. Among the comments of rubber manufacturers of that time were: "I have no use for chemists, druggists, and apothecaries"; "I would give more for the guess of my old superintendent than for all the certainties of the best chemist on earth"; "I had employed chemists but their cost to the company had been greater than any value received from their work."

In 1899 the chemist, Arthur H. Marks, invented the alkali reclaiming process, and in 1906 George Oenslager discovered organic accelerators. Rubber technology was being revolutionized by the chemist, and larger profits were in sight. The tight grip on the purse strings became loosened somewhat, and money was being cautiously expended on research. Practical and immediate results which could be translated into hasty profits were the principal aims. Little encouragement was afforded those who wanted to tackle fundamentals. Competition was keen among manufacturers; the rubber industry was growing rapidly, and no time or money was available for abstract reasoning or for "profitless" research enterprises.

Rubber manufacturers were quite willing for their chemists to meet with chemists of other companies provided they did not divulge any of the firm's "secrets." With most of those attending these early meetings in the role of listeners, little was accomplished in furthering the knowledge of rubber chemistry through the exchange of ideas. Such was the problem during the life of the Rubber Section and through the earlier years of its healthier successor, the Division of Rubber Chemistry.

The American Chemical Society — 1876

Before considering the historical development of the rubber division, a brief resume of the early history of the parent organization, the American Chemical Society, is of interest. The society had its inception in the Summer of 1874, when a representative group of chemists met at Northumberland, Pa., to celebrate the centennial of the discovery of oxygen by Dr. Joseph Priestly and other notable discoveries of the year 1774. This meeting resulted in the formation of a subsection of chemistry in the American Association for the Advancement of Science. Many progressive chemists of the day, however, were not satisfied and wanted a completely independent organization. To further this aim a meeting was held on January 27, 1876, in the New York City home of Professor C. F. Chandler, of Columbia University, and a committee was named to attend to the preliminaries of organization.

The organization meeting was held April 6, 1876, at the College of Pharmacy in New York. John W. Draper was elected first president of the new society; while W. M. Habirshaw, well-known throughout the rubber trade of that time, was made treasurer. The first membership list contained the names of 53 resident (New York City) and 80 non-resident members, a total of 133. The first regular meeting after organization was held May 4, 1876, and by December of that year the membership had grown to a total of 230, and in 1901, 25 years after its origin, the society boasted of a membership of 1,809. This year, 1939, the society membership rolls number 23,300.

On November 9, 1877, the American Chemical Society was legally incorporated under the laws of the State of New York, the incorporation being adopted by the society at its meeting on December 6, 1877. After a steady growth of 60 years under the New York charter, the society was reencorporated on January 1, 1938, under the federal laws. Through the adoption of the national charter which became available through an act of Congress the society now legally conforms to its national scope.

Objects of the A.C.S.

During its 63 years of existence the American Chemical Society has striven for the following objects: the advancement of chemistry in all of its branches; the promotion of research in chemical science and industry; the improvement of the qualifications and usefulness of chemists through high standards of professional ethics, education, and attainments; the increase and diffusion of chemical knowledge; the promotion of scientific interests, education, and inquiry; and the development of our industries by chemical aid. The objects of its branches are the same as those of the society. The rubber division

has gone far on this road of progress despite the handicaps encountered during the period extending from the time of its inception to that of general acceptance by the industry.

Rubber Chemistry Section, A.C.S.—1909

Predecessor of the Division of Rubber Chemistry was the India Rubber Chemistry Section, later known as the Rubber Chemistry Section. Organization was effected on December 30, 1909, at a meeting of the American Chemical Society in Boston, Mass. The purpose set forth by this enterprising group of 28 men, present at the initial meeting, was to bring together at occasional meetings chemists and others interested in the field of rubber so that many problems of moment and interest could be solved by united effort. High hopes were held for the new section, and it was generally anticipated that a regular division would be organized within a very short period.

The first chairman of the new section was Charles C. Goodrich, and the first secretary, Frederick J. Maywald. Among the others actively associated with the section at its inception were: Edward A. Barrier, Milton E. MacDonald, William G. Hills, Sheldon P. Thatcher, W. C. Geer, G. Oenslager, Harvey M. Eddy, H. Hughes, Harold van der Linde, M. L. Allard, C. R. Boggs, C. E. Waters, and G. H. Savage.

The high enthusiasm of the new enterprise soon died down when subsequent meetings were held without constructive results of any consequence. At this time chemical developments in the rubber industry were not generally protected by patents, and manufacturers were extremely careful to prevent disclosure of their processes and developments. This reticence naturally retarded the development of the Rubber Section. Early activities were limited chiefly to the standardization of methods of chemical analysis and physical tests of rubber articles. Mutual effort in this phase of activity, however, struck a snag when rubber companies refused to reveal their methods of analysis, even when this information was to be treated with confidence as to the source.

Conditions were so bad that the following statement[1] was issued in 1911: "The American Chemical Society is very anxious that those of its members interested in the chemistry of India rubber should have their problems considered and solved. The India Rubber Section has had two meetings but there is not yet sufficient evidence of real cooperative effort among the rubber chemists to insure success. The methods of analysis of India rubber are in almost a chaotic condition. The usual specifications for rubber goods meet the approval only of those who make them. The general chemistry of India rubber is sadly in need of improvement.

"Only the chemists actively interested in the India rubber industry can hope to improve affairs, and it is, accordingly, necessary that they should really get together without too many padlocks on their lips if results are to be accomplished. It is certainly true that there are secrets of the rubber trade which cannot be disclosed, nor is there any desire that they should be disclosed, but when certain firms decline even to allow their methods of analysis to be known, it would certainly seem that secrecy is carried too far. The Section can never become a success if every member goes to its meetings with no idea of his responsibilities toward helpfulness, but simply to learn from others, many of whom may be in a similar position."

In connection with the working out of standard methods of analysis much credit must be given to the Joint Rubber Insulation Committee, a group of manufacturers and consumers of insulated wire, which was formed in 1911 and supplied much of the data on tests utilized by the Rubber Section.

The papers presented at the meetings of the Rubber Section dealt largely with analytical methods, although occasionally other subjects were discussed, paving the way for future divergence of topics in the days of the Divi-

[1] India Rubber World, Sept., 1911, p. 496.

Members Present at the Meeting of the Rubber Section, A.C.S., at the

sion of Rubber Chemistry, its successor. At a meeting of the section in December, 1911, the subject of synthetic rubber was brought up by D. A. Cutler, section chairman, who spoke of experiments on synthetic rubber from isoprene obtained from turpentine. At the same meeting F. E. Barrows gave a short talk on the formation of the rubber molecule.

Toward the end of the section's decade of existence the fruits of its labor were becoming evident. Analytical and test proceduures were being perfected, and discussions on other subjects were becoming more frequent and livelier. The World War and rapid growth of the automotive industry had spurred technical activity in the rubber industry.

Meetings of the section were usually held in conjunction with those of the American Chemical Society, and with the exception of the years 1910 and 1915 the section met during each year of its existence. The following table presents a resume of the section's activities, its chairmen, and its secretaries.

MEETINGS OF THE RUBBER CHEMISTRY SECTION, AMERICAN CHEMICAL SOCIETY

Date	Place	Attendance	Chairman	Secretary
Dec., 1909	Boston	28	Chas. C. Goodrich	F. J. Maywald
June, 1911	Indianapolis	16	Chas. C. Goodrich	F. J. Maywald
Dec. 1911	Washington	54	Chas. C. Goodrich	F. J. Maywald
Apr., 1912	New York	36	D. A. Cutler	D. Whipple
June, 1912			D. A. Cutler	D. Whipple
Mar., 1913	Milwaukee		D. A. Cutler	D. Whipple
Sept., 1913	Rochester		D. A. Cutler	D. Whipple
Apr., 1914	Cincinnati		D. A. Cutler	D. Whipple
Sept., 1916	New York	110	L. E. Weber	J. B. Tuttle
Sept., 1917	Cambridge	80	L. E. Weber	J. B. Tuttle
Sept., 1918	Cleveland	80	L. E. Weber	J. B. Tuttle

The following list of names, believed to be quite comprehensive, has been compiled from the records examined in which mention was made of their helpful activities during the existence of the Rubber Section.

NAMES CONNECTED WITH THE RUBBER SECTION—1909-1919

W. A. Ducca	C. E. Waters	I. V. Stone
J. B. Tuttle	G. H. Savage	J. A. Schaeffer
D. A. Cutler	M. E. MacDonald	H. B. Rodman
D. Whipple	L. G. Wesson	N. G. Madge
C. C. Goodrich	P. H. Walker	W. H. Smith
F. J. Maywald	W. W. Evans	H. Fay
C. M. Knight	F. E. Barrows	J. Westesson
E. A. Barrier	E. W. Boughton	C. P. Fox
W. G. Hills	C. D. Young	W. E. Piper
W. C. Geer	E. H. Johnson	G. T. Cottle
S. P. Thatcher	H. S. Upton	A. D. Hopkins
G. Oenslager	L. J. Plumb	D. Spence
H. M. Eddy	D. F. Cranor	J. W. Schade
H. Hughes	R. B. Earle	T. L. Wormley
H. van der Linde	A. H. Smith	J. E. Weber
M. L. Allard	H. E. Simmons	L. Yurow
C. R. Boggs		O. H. Klein

Early in 1919 plans to make the Rubber Chemistry Section a division began taking shape. By-laws were being prepared to submit to the Council of the American Chemical Society at its next meeting. Members of the executive committee of the section active in the formation of the division were: J. B. Tuttle, chairman, D. Spence, G. Oenslager, L. E. Weber, H. E. Simmons, L. H. Plumb, and A. H. Smith.

The Division of Rubber Chemistry, A.C.S.—1919

Recognizing the efforts of American rubber chemists to promote a high standing of scientific attainment in their industry, the Council of the American Chemical Society, meeting at Buffalo, N. Y., on April 7, 1919, authorized the organization of the rubber division. With this recognition came the obligation on the part of rubber chemists to cooperate to the fullest extent in raising the standard of their work.

The newly formed Division of Rubber Chemistry consisted essentially of the same group of men active in the

...at the Massachusetts Institute of Technology, Cambridge, Mass., September 12, 1917

old Rubber Section. However any action taken by the Rubber Section had not been official until approved by the parent society. The supervision of the section was entirely in the hands of the president and secretary of the American Chemical Society. Now, however, the rubber chemists could have a permanent organization, with officers elected by themselves; they could enroll their own members, and in general, act as a permanent body.

Great optimism reigned among the leaders of the new enterprise, and it was generally felt that the 10-year old bogey of secrecy was at an end. The ban on research disclosures, however, had not ended, and the early life of the new division was concerned with fighting for greater freedom and expression of thought, as well as with the promotion of research on the fundamentals of rubber chemistry and physics.

The first meeting of the Division of Rubber Chemistry was held in Philadelphia, Pa., in October, 1919, under the chairmanship of J. B. Tuttle, who was active in the old Rubber Chemistry Section and in the formation of the new division. Records show that a series of papers of a high order of merit were presented at this initial meeting. At subsequent meetings of the division a marked tendency to "open up" was noticeable. Less and less secrecy was being maintained by the various companies regarding their research activities and their developments in rubber compounding. This trend was promoted by the influx of new technical men into the industry and by the increased utilization of patents for protection of processes and chemicals. As this move gained favor, the meetings were attended with increased interest. Cooperation was at last being achieved; the members of the new division felt that the time was ripe for further extension of research. At a meeting in New York in September, 1921, the division expressed its sentiment for cooperation in research between different manufacturers and also between manufacturers and producers by addressing the following resolution to the Rubber Association of America.

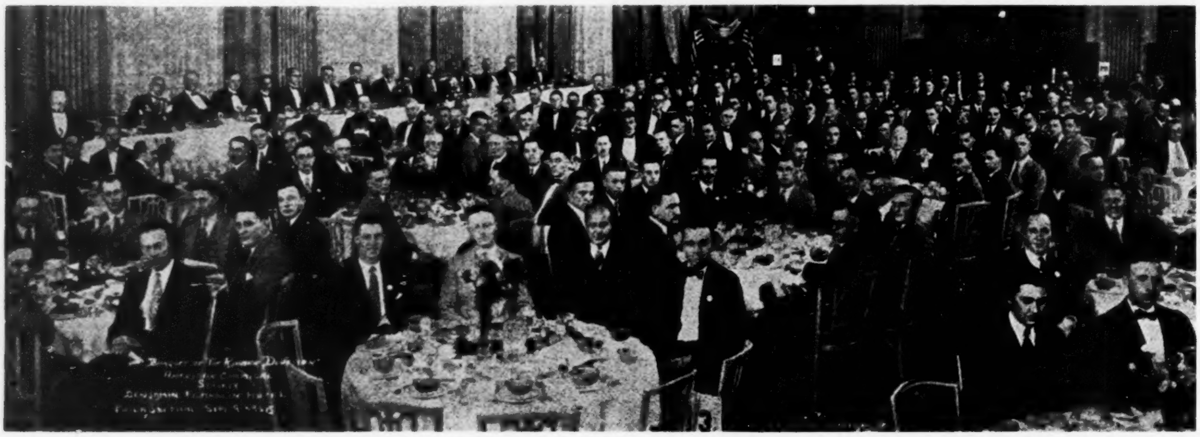
"It is a recognized fact that there are certain fundamental principles of general interest to the rubber industry as a whole which no single company should be expected to develop. Therefore it is the sense of the Rubber Division, A.C.S., numbering approximately 200 members from all leading companies, both large and small, . . . that a cooperative research laboratory be established under the auspices of the Rubber Association of America for furthering the investigation of such fundamental problems."

This plea for cooperative research went unheard, and we have heard it reechoed recently when W. C. Geer, pioneer in the formation of the old Rubber Section, addressed the members of the New York Group of the Rubber Division on "Research Cooperation in the Rubber Industry" on October 15, 1937, 16 years after the 1921 proposal. Today, 30 years after the foundation of the Rubber Section, the challenge still remains; the solution of this problem may have an important bearing on the destiny of the rubber industry of the future.

The years passed, and the division grew in strength and knowledge. Antioxidants were introduced to the industry, and accelerated aging tests entered the scene. Carrying on the labors of the old Rubber Section, test methods were further improved. Physical testing methods occupied much of the energies of the division during the late 1920s. Throughout the years of its existence, the division has held numerous symposiums on subjects of far-reaching significance to the chemistry of rubber. It has cooperated measurably with the work of rubber men abroad in efforts to strengthen the world-wide position of the industry. A high spot in this endeavor was the division's cooperation in the recent Rubber Technology Conference, held in London, England, in May, 1938, under the auspices of the Institution of the Rubber Industry. A large number of meritorious papers were presented by American rubber technologists.

The rapidly growing Division of Rubber Chemistry had become so large by 1927 that it was considered advisable to extend its activities along other channels closely allied with the interest of the rubber chemist. There had been a growing demand for a unit publication in this country to contain all of the technical articles of interest to the rubber chemist and technologist. There had also been a demand for special meetings at geographical points more convenient to the individuals of the industry. Thus, at a divisional meeting in Detroit, Mich., in September, 1927, the executive committee was empowered to proceed with plans for the formation of local groups and for the establishment by the division of a special publication composed largely of rubber reprints from *Industrial and Engineering Chemistry*. These innovations will be discussed in subsequent sections of this article.

Within the space of these few pages it would be impossible to mention all of the names of those active in furthering the work of the division; nor would it be possible to cover the entire range of its activities and to indicate, except generally, the wide scope covered by the research of its members. The rubber industry owes a large measure of gratitude to the Division of Rubber



Banquet of the Division of Rubber Chemistry, A.C.S., Philadelphia, Pa., September 9, 1926

Chemistry, even to the least of its members, for furthering the science of rubber. The following table presents a brief resume of the division's meetings with the chairmen and secretaries.

Meetings of the Division of Rubber Chemistry, A.C.S.

Date	Place	Attendance	Chairman	Secretary
Apr., 1919	Buffalo	Division authorized by Council, A.C.S.		
Oct., 1919	Philadelphia		J. B. Tuttle	A. H. Smith
Apr., 1920	St. Louis		W. K. Lewis	A. H. Smith
Sept., 1920	Chicago	100	W. K. Lewis	A. H. Smith
Apr., 1921	Rochester		W. W. Evans	A. H. Smith
Sept., 1921	New York	200	W. W. Evans	A. H. Smith
May, 1922	Birmingham	35	C. W. Bedford	A. H. Smith
Sept., 1922	Pittsburgh	140	C. W. Bedford	A. H. Smith
Apr., 1923	New Haven	150	W. B. Wiegand	A. H. Smith
Sept., 1923	Milwaukee	150	W. B. Wiegand	A. H. Smith
Apr., 1924	Washington	150	E. B. Spear	A. H. Smith
Sept., 1924	Ithaca	125	E. B. Spear	A. H. Smith
Apr., 1925	Baltimore	115	C. R. Boggs	A. H. Smith
Feb. 1926	Akron	293	J. M. Bierer	A. H. Smith
Sept., 1926	Philadelphia	300	J. M. Bierer	A. H. Smith
Apr., 1927	Richmond	135	R. P. Dinsmore	A. H. Smith
Sept., 1927	Detroit	192	R. P. Dinsmore	A. H. Smith
Apr., 1928	St. Louis	140	H. L. Fisher	H. E. Simmons
Sept., 1928	Swampscott	300	H. L. Fisher	H. E. Simmons
May, 1929	Columbus	250	A. H. Smith	H. E. Simmons
Sept., 1929	Atlantic City		A. H. Smith	H. E. Simmons
Apr., 1930	Atlanta	115	S. Krall	H. E. Simmons
Sept., 1930	Cincinnati	150	S. Krall	H. E. Simmons
Apr., 1931	Indianapolis		H. A. Winkelmann	H. E. Simmons
Sept., 1931	Buffalo		H. A. Winkelmann	H. E. Simmons
Feb., 1932	Detroit	130	E. R. Bridgwater	H. E. Simmons
Aug., 1932	Denver		E. R. Bridgwater	H. E. Simmons
Mar., 1933	Washington		L. E. Sebrell	H. E. Simmons
Sept., 1933	Chicago		L. E. Sebrell	H. E. Simmons
Mar., 1934	St. Petersburg		Ira Williams	H. E. Simmons
Sept., 1934	Cleveland	450	Ira Williams	H. E. Simmons
Apr., 1935	New York	450	S. D. Cadwell	H. E. Simmons
Sept., 1935	Akron	450	S. D. Cadwell	H. E. Simmons
Apr., 1936	Kansas City	75	N. A. Shepard	C. W. Christensen
Sept., 1936	Pittsburgh	350	N. A. Shepard	C. W. Christensen
Apr., 1937	Chapel Hill	125	H. L. Trumbull	C. W. Christensen
Sept., 1937	Rochester	367	H. L. Trumbull	C. W. Christensen
Mar., 1938	Detroit	300	A. R. Kemp	C. W. Christensen
Apr., 1939	Baltimore	350	G. K. Hinshaw	H. I. Cramer
Sept., 1939	Boston		G. K. Hinshaw	H. I. Cramer

Formation of Local Groups

To carry out the purpose of the Division of Rubber Chemistry to enlarge its activities by means of group organizations, geographically distributed, Harry L. Fisher, division chairman, appointed during the latter part of 1927 local group chairmen for the preliminary work in their respective geographical sections as follows: R. P. Dinsmore, Akron; C. R. Boggs, Boston; A. A. Somerville, New York; and R. B. Stringfield, Los Angeles.

New York—January 11, 1928

No time was lost in launching these new enterprises. The first meeting of the New York Group was held January 11, 1928, at the Beaux Arts Restaurant, New York. With 240 in attendance, organization was quickly effected by the spontaneous and unanimous election of W. A. Gibbons as group chairman and Donald F. Cranor as secretary-treasurer. At the speakers' with A. A. Somerville, chairman of the occasion, was the guest of honor, Francis R. Henderson, president of the Rubber Exchange of New York, H. L. Fisher, chairman of the Division of Rubber Chemistry, and the following ex-chairmen of the division: J. B. Tuttle, W. W. Evans, C. R. Boggs, E. B. Spear, J. M. Bierer, and W. B. Wiegand.

Akron—February 15, 1928

Not long afterward, on February 15, the Akron Group got under way, holding its first meeting at the Akron City Club, in Akron. Chemists and engineers attending this affair totaled 300. As leaders for the new group H. A. Winkelmann was elected chairman, W. H. Fleming, vice-chairman, and R. J. Bonstein, secretary-treasurer.

Los Angeles—May 11, 1928

Preliminary to organization of the Los Angeles Group a get-together meeting was held and 45 members were enrolled in the projected group. District organizer, R. B. Stringfield, was elected temporary president, and E. S. Long, temporary secretary. A committee composed of C. R. Park, E. S. Long, and A. K. Pond was named to formulate a plan of organization. A meeting of the new group was held on May 11, 1928, and organization was carried out with the adoption of a constitution and by-laws and the official enrollment of 63 members. The first regular officers of the West Coast group were elected as follows: R. B. Stringfield, president; A. K. Pond, vice president; E. S. Long, secretary-treasurer; and C. R. Park, E. S. Long, and A. K. Pond, executive committee.

Boston—November 7, 1928

Fourth to carry out organization was the Boston Group under the direction of C. R. Boggs. The first meeting, held preliminary to official organization, took place on May 9, 1928, in the Chamber of Commerce Building, Boston, Mass. There were 285 present, and at the head table sat many well-known rubber men from New England: C. R. Boggs, F. C. Hood, Everett Morss, W. D. McPherson, J. W. Fellows, J. M. Bierer, J. T. Blake, T. K. Sherwood, and K. Frolich. Formal organization was deterred owing to the length of the program. At a second meeting on November 7, 1928, the group was officially started with J. M. Bierer elected as chairman and T. M. Knowland as secretary-treasurer.

Chicago—June 28, 1929

The year following the formation of these four initial groups saw the organization of the Chicago Group. A meeting of the general organization committee was held in Chicago on June 28, 1929. The purpose of the group was outlined by the committee as a plan toward closer cooperation between the laboratory and factory through presentation of papers of interest to both factions. Officers elected to carry out the work of the group were C. Frick, chairman; Otto Urech, vice chairman; and B. W. Lewis, secretary-treasurer. First meeting of the newly organized group was held on October 25, 1929, at Chicago, in conjunction with a meeting of the Chicago Section of the American Chemical Society.

Detroit—June 23, 1937

With local groups well established in the chief rubber centers of the country, the Rubber Division did not further expand its group organizations until 1937 when the Detroit industrial area, fast growing in prominence as a rubber center, was included in Rubber Division activities through the formation of the Detroit Group. With 75 in attendance, the group held its first meeting on June 23, 1937, and elected the following: chairman, W. J. McCourtney; vice chairman, E. J. Kvet; secretary-treasurer,

J. A. Bumpus; chairman of the membership committee, H. C. Anderson; and chairman of the entertainment committee, J. H. Norton.

The work of these local groups is well known to all in the rubber industry. They afford an opportunity for supplementing and extending the technical activities of the division and for those present from the rubber and allied industries to become better acquainted so as to encourage a spirit of cooperation and thus increase the benefits possible from the exchange of ideas.

"Rubber Chemistry and Technology"

In the year 1928 which saw the formation of the four local groups, the first issue of *Rubber Chemistry and Technology,* the division's paper of reprints, was published, Vol. 1, No. 1, being dated April, 1928. C. C. Davis, well known to the rubber trade for his contribution in developing the Bierer-Davis oxygen bomb and later for his co-editorship of the A.C.S. monograph, "Chemistry and Technology of Rubber," was chosen as editor and has remained in that capacity ever since. The service that this valuable publication has rendered during the past 11 years is recognized by the industry, containing as it does reprints of the most important papers on fundamental research, technical developments, and chemical engineering problems relating to rubber. In addition to reprints of papers presented in the English language, translations of important foreign language papers are published.

Crude Rubber Committee—April 23, 1935

The wide variability in crude rubber has always been a source of much trouble to the rubber industry. In the early days the solution of this problem was a hopeless task with almost numberless varieties of crude rubber on the market, practically all of which contained large amounts of dirt and impurities. As wild rubber became displaced by the plantation grades, there was hope of attaining some degree of uniformity. Two committees of the rubber division, The Crude Rubber Testing Committee and the Raw Rubber Specification Committee, labored on this problem during the 1920s, but achieved little success. In addition to the wide variability of the rubber available, they were deterred by the lack of standard procedures for evaluating quality.

On April 23, 1935, a new Crude Rubber Committee was appointed by S. M. Cadwell, division chairman, who acted on the suggestion of Edgar Rhodes, of the Rubber Research Institute of Malaya, that American rubber consumers organize for closer cooperation with those engaged in crude rubber production. The new committee, headed by H. Gray, was delegated to: promote a better understanding between producers and consumers of crude rubber; facilitate the exchange of information on the quality requirements for various crude rubbers, including latex; discuss quality requisites with technical agencies allied with producers, methods of testing, and evaluation of new types of rubber and latex. Since its origin this committee has accomplished much through cooperation with producers in increasing the uniformity of crude rubber and in outlining procedures to determine the quality of crude rubber and latex. There is more to be done along this line, and the present activities of the committee, now headed by R. H. Gerke, indicate that every effort is being made to further this work.

Conclusion

This year, 1939, a century after the discovery of vulcanization, which was fittingly celebrated by the Rubber Division at its Boston meeting September 11 to 15, marks the thirtieth anniversary of the formation of the old Rubber Chemistry Section of the A.C.S. During this period we have seen the rubber industry in all its phases undergo a tremendous growth, both industrially and scientifically. It would not be unfair to say that this far reaching development was materially assisted by the activities of those organized groups of rubber chemists within the American Chemical Society. As long as the spirit of cooperation and contribution toward technical development is maintained within this body, we need have no fear for the future of the rubber industry.

A Century After Goodyear

(*Continued from page* 66)

how crude rubber can be elongated or racked several thousand per cent. by alternate heating, stretching, and cooling.

Vulcanization may enhance elasticity in several ways. The intramolecular reaction of sulphur or other vulcanizing agent may decrease association or van der Waal's forces; the vulcanizing agent may catalyze further polymerization or may link up the molecules in a purely linear fashion by reaction with end groups to increase molecular weight or it may react intermolecularly to cross link adjacent molecules.

Although some progress has been made toward arriving at an adequate explanation of vulcanization, the subject is still very much confused. In view of the present research activity in the field of rubber and other natural and synthetic high polymers and the likelihood that improved methods of studying these substances will be developed, one might safely predict that the present state of complexity in which we find the vulcanization problem will give way to a much clearer understanding before another century passes by. The structural chemistry of the vulcanization process in all of its ramifications, however, is so complex that progress is likely to be slow.

Rubber Industry Abroad

(*Continued from page* 72)

In the early days the machinery used was imported from Europe and America, but the Japanese soon began to manufacture small calenders and mills. In 1905, Henry C. Pearson, founder of India Rubber World, visited Japan and saw some of the oldest locally constructed machinery which had been designed by an ambitious rubber manufacturer from illustrations found in a mechanical dictionary.

Influence on the Rubber Industry

Although the principal event in the history of the rubber industry, the discovery of vulcanization, was consummated in the United States of America, many European countries were well abreast, or in some instances ahead of American progress. However upon the advent and rapid adoption of the automobile in the United States, the position and economic importance of the rubber industry abroad assumed lesser relative proportions. Nevertheless the development and progress in the Old World were important factors in the early history of the rubber industry.

Rubber Chemists Celebrate Centenary of Vulcanization at Fall Meeting

THE regular semi-annual meeting of the Division of Rubber Chemistry, American Chemical Society, was held in conjunction with the ninety-eighth meeting of the parent organization in Boston, Mass., during the week of September 11 to 15. Approximately 4,000 members and guests were recorded in the general registration of the society, with an unusually large attendance at the Rubber Division. The theme of the Rubber Division throughout its sessions and of the entire society at the general session and banquet, which were under the auspices of the Division of Rubber Chemistry, was the "Celebration of the Centenary of the Discovery of Vulcanization of Rubber by Charles Goodyear."

Headquarters of the Rubber Division were at the Parker House where the technical and business meetings were held on September 14 and 15, and the general registration for the society and the various divisions was conducted at the Statler Hotel. No separate records were kept for the various divisions, but it is estimated that approximately 400 attended the technical sessions of the Division of Rubber Chemistry. The program and abstracts of the sixteen papers presented at the Symposium on the Vulcanization of Rubber and the nine general papers were published in the September issue of INDIA RUBBER WORLD and will not be referred to in detail in this report. Because of the absence of English and French authors resulting from present European conditions the four papers submitted from abroad were read by Americans.

Crude Rubber Report

Report No. 8 of the Crude Rubber Committee composed of R. H. Gerke (chairman), E. B. Babcock, W. D. Parrish, G. A. Sackett, and J. C. Walton was given by Chairman Gerke on September 15 and gave evidence of concentrated effort on the part of the committee with the accruing worth-while progress in its activities. Tentative procedures for testing the variability of normal and concentrated latex have been returned in galley form to the editor of the Analytical Edition of *Industrial and Engineering Chemistry* for publication. The development of an apparatus for the determination of mechanical stability of latex is under way. A practical and precise procedure for quantitative dirt determination is being sought, and progress is reported in the investigation. A method for testing the variability of rubber with respect to plasticity is being developed. Both viscosity and retentivity are receiving attention. Also consideration is being given to the possibility of securing and publishing as a paper data regarding the mean value for the rate of vulcanization of first-grade rubbers as observed in United States factories. This information would assist producers in selecting a rate of cure satisfactory to consumers. Previous reports of the Crude Rubber Committee have been consolidated and submitted to *Rubber Chemistry and Technology* for publication.

Other Business

By-laws of the Division of Rubber Chemistry were presented by C. W. Christensen, chairman of the special committee, for consideration and were unanimously adopted by the division at the afternoon meeting on September 15. These by-laws do not materially change the practices carried on in the past, but provide for certain committees and permit the division to operate officially under the national charter recently received by the American Chemical Society.

Dr. H. L. Trumbull, chairman of the Nomenclature Committee, reported progress in organization of the investigation and cooperation with the American Society for Testing Materials. He stated that application would be made for approval by the Executive Committee for a sum of money to cover the cost of mailing inquiries to the members of the Rubber Division so as to benefit from their individual views.

As a representative of the National Research Council of Canada, T. R. Griffith extended his felicitations and spoke briefly of the Canadian organization.

Officers elected for the coming year are: vice chairman, R. H. Gerke; secretary, H. I. Cramer; treasurer, C. W. Christensen; sergeant-at-arms, C. P. Hall; and three executive committee members, W. Busse, A. H. Nellen, and J. H. Ingmanson. Having been vice chairman during the past year, E. B. Curtis automatically becomes chairman for the ensuing year. After the completion of the election, the outgoing chairman, G. K. Hinshaw, called the new officers to the rostrum and after introducing them turned the meeting over to Chairman Curtis who proceeded with the two remaining papers of the program.

General Celebration Meeting

In Symphony Hall at two o'clock on September 13, Mr. Hinshaw presided over the general meeting of the American Chemical Society which had been arranged as a special commemoration of the Founding of the Rubber Industry. Although the meeting was held under the auspices of the Division of Rubber Chemistry, the great interest of the entire society was manifested in the large attendance.

In his opening remarks Chairman Hinshaw paid tribute to Charles Goodyear as the man who during the year of 1839 in Woburn, Mass., achieved success after having labored, dreamed, sacrificed, starved, and neglected the welfare of his family to achieve an end, not for glory, fame, or profit, but for the benefit of his fellow men. After stating that not only was a discovery made in this small village in 1839, but there occurred "The Birth of an Industry," the modern Rubber Industry, Mr. Hinshaw welcomed the entire American Chemical Society to join in this "The Centennial Celebration Commemorating the Discovery of the Vulcanization of Rubber." He then introduced C. A. Kraus, president of the American Chemical Society, who extended greetings to the members and guests who were present at this, the ninety-eighth meeting.

Speaking on the subject "What is Vulcanization?" E. B. Babcock told of the economic and political conditions during the period of Goodyear's tangible results and discovery which had a very distressing effect upon the then rubber industry, and he reviewed the important events relating to rubber up to the time of vulcanization. Stating that vulcanization, as ordinarily conceived, can be defined as the process of combining sulphur with rubber under

the influence of heat, and reiterating the time-worn question as to chemical change or physical phenomenon, he said that it is now definitely established that sulphur goes into chemical combination with rubber, but that most rubber technologists agree that the results are due to combined chemical and physical forces. In relation to recently published definitions in terms of the changes in properties, Mr. Babcock enumerated some of these changes and discussed briefly the presumable reaction of sulphur, still the universal vulcanizing agent, with rubber, but stressed the possibility of varying the process and the resulting product, thereby creating an infinite variation in the properties of rubber mixtures.

Speaking on "Thomas Hancock," an English rubber-working contemporary of Goodyear who among many other accomplishments invented the Masticator and re-invented vulcanization by emersion in molten sulphur. Alfred A. Glidden said, " . . . in our own art of rubber manufacturing there has lived no hero or pioneer more worthy of our admiration and gratitude than Thomas Hancock of England. Thomas Hancock not only was a pioneer, but knew from the start that he was engaging in a new field of importance. He left behind him an astonishing number of discoveries and developments in the manufacturing of rubber and also a collection of invaluable comments on his life work in his "Personal Narrative of the Origin and Progress of the Caoutchouc and India-Rubber Manufacture of England."

In discussing Hancock's work and achievements, Mr. Glidden divided his remarks into three parts: Thomas Hancock, the Man; Thomas Hancock's Achievements; and An Evaluation of His Work in Relation to Its Effect on the Rubber Manufacturing Industry.

In the absence of R. W. Lunn, of Leyland, England, his tribute to Charles Goodyear was read by William B. Wiegand. Very ably summarizing the essentials from Goodyear's life and achievements which indicate his remarkable perseverance toward his objective and his utter disregard for his own personal welfare, Mr. Lunn paid homage "to the man who laid the real foundation to these industries [rubber and automotive] by his discovery of vulcanization one hundred years ago."

W. A. Gibbons spoke on "The Rubber Industry—1839-1939." After discussing the characteristics of rubber and the technical aspects of Goodyear's invention, Mr. Gibbons traced the advancements in the rubber industry throughout the past 100 years in relation to the following influential phases: (1) commercial development to 1890, (2) plantation rubber, (3) invention of the pneumatic tire, (4) scientific work to 1890, (5) the structure of rubber, (6) theory of vulcanization, (7) accelerators, (8) non-rubber ingredients, (9) compounding and re-enforcement, (10) compounding, (11) antioxidants and improvement in aging resistance, (12) industrial use of latex, (13) use of latex in other industries, (14) synthetic rubbers, and (15) the modern tire.

In conclusion, Mr. Gibbons said, "While we are met today to celebrate the one hundredth anniversary of the discovery, this meeting is not the real memorial to this great inventor. 'If you would see his monument, look about you' and observe the great industry which he founded, whose products have been vital to still greater industries and have contributed to the safety, comfort, and prosperity of mankind."

Commemoration Banquet

More than one thousand members and guests of the American Chemical Society convened at the banquet held in the ballroom of the Copley Plaza Hotel on September 13 to do homage to the discoverer who made the rubber industry possible. Directly back of the speakers' table the huge original painting on hard rubber of Charles Goodyear was draped in the glory of the American flag.

After enjoying a very delectable dinner, those present were greeted by John M. Bierer, toastmaster for the evening, who included in his remarks a classification of the history of the rubber industry into four periods: the first began when the unknown inventor in South America discovered that shoes could be made by pouring latex on his feet; the second period extended from the time of the discovery of vulcanization by Goodyear in 1839 to the advent of organic accelerators; the third or scientific period was the thirty years immediately following; and the fourth period started with the appearance of the first important substitutes for rubber. In celebration of the beginning of the second period in which "nearly all the rubber products of today were developed and put to practical application," Mr. Bierer characterized two leaders of great renown as "Charles Goodyear of New England—inventor—dreamer—idealist—a man unselfish in his purpose—a financial failure" and "Thomas Hancock of old England—the alert and practical manufacturer. Both had a vision of the possibilities of vulcanized rubber. Goodyear conceived an idea; Hancock developed it and made it a success."

P. W. Litchfield on the subject, Rubber's Position in Modern Civilization, stated that the outstanding characteristics of this modern civilization—transportation, mass production, communication and mass hygiene—were not created by rubber.

"Rubber is the fluxing material without which they would be either totally impossible or tremendously restricted," he continued. Rubber's position in modern civilization is fixed by the facts that four million persons, the world over, are employed in the rubber business; almost three billions of dollars are invested in facilities for the growing, manufacture, and distribution of rubber; more than fifty thousand different and useful products are made from rubber; and in excess of two billion pounds of pure rubber are consumed in a normal year. After emphasizing the important technological developments and discussing the widespread influence of many typical applications of rubber, Mr. Litchfield said, "We know a comfort and perfection of living such as has been known to no other age. Much of the pattern of our modern scheme traces directly to the tenacity and faith of Charles Goodyear. . . . It is indeed fitting that we should honor the memory of this truly great man."

The next speaker, Karl T. Compton, M.I.T. president, addressing the assemblage on Looking Forward in Research, actually gazed into a crystal ball and brought forth the observation that the possibility for advantageous use of our knowledge increases somewhat as the square of the number of facts of which our knowledge is comprised. He said he believed that no research really deserves the name if its results could be foretold when it began. Summarizing briefly some of the past accomplishments, he foresaw the probability of coordination of present knowledge so as to produce greater results by extension of research from the known to the unknown. Specifically President Compton reasoned that as science has been applied to make warfare more destructive and likewise to bring about a certain compensating degree of protection against new weapons, so can it be used to reduce the causes of war, particularly by providing the desirables of individual and national life so as to remove the incentive for taking from others by force. To the extent that great groups of people, such as nations, can be induced to support technological developments directed toward these ends, to that extent can they satisfy their

desires without recourse to war. President Compton closed with a quotation from Pasteur as directly bearing upon our present generation.

"In our century science is the soul of the prosperity of nations and the living source of all progress. Undoubtedly the tiring discussions of politics seem to be our guide. Empty appearances! What really leads us forward is a few scientific discoveries and their application."

James B. Conant, head of Harvard University, concluded the program with Lessons from the Past. With the growth of this new industry, born one hundred years ago, came the growth of a new science, the chemistry of polymers, of large molecules. When Charles Goodyear found that sticky raw rubber could be converted into a new and useful material by heating with sulphur and lead oxide, he undoubtedly made a chemical discovery, but a century later we chemists are still uncertain as to the exact nature of his discovery.

After emphasizing the interrelation or partnership between the rubber and the automobile industries, President Conant said, "This much seems clear—in the past science and industry have prospered together. Each has influenced the other and each has altered society and in turn responded to society's demands. . . . If we view the history of science in relation to the history of society, we are led to characterize the relation of industry to pure science by the word symbiosis (which means living together), not by the word parasitism which implies a host and a devouring parasite."

Having reminded his listeners of a number of examples of symbiosis in the developments of the past, President Conant closed with these remarks, "So industrialists and scientists may well join together in celebrating either a great discovery in pure science or a revolution in the industrial arts. For on close analysis both events are seen to be of equal significance for the attainment of those goals for which the two groups strive. And they may ask the other members of the community to join with them when they pay honor, as tonight, to a pioneer who opened doors to riches for mankind he little dreamed of. Treasures not measured in material terms alone, new weapons in man's intellectual armory—perhaps the only enduring wealth of modern times."

Favors presented to each one present at the banquet consisted of: (1) a very handsome souvenir book of the centennial celebration which contained a reproduction of an engraving in 1862 from the original painting "Men of Progress" (Goodyear and eighteen contemporaries) by C. Schussele in 1861, the photographs and speeches of those appearing on the programs at the general session and banquet on September 13, and facsimile reproductions of Goodyear's patent, three contemporary newspaper advertisements relating to rubber goods of Charles Goodyear and the patent papers granted Thomas Hancock in England; (2) a bound centennial volume, published in 1939 for this occasion, of the writings of Charles Goodyear and Thomas Hancock comprising "Gum-Elastic and Its Varieties with a Detailed Account of Its Applications and Uses and of the Discovery of Vulcanization" by Charles Goodyear, two volumes published for the author in 1855 and the "Personal Narrative of the Origin and Progress of the Caoutchouc or India-Rubber Manufacture in England" by Thomas Hancock published in one volume in 1857; and (3) a sterling silver cocktail shaker bearing the likeness of Charles Goodyear on the cover.

Rubber Exhibit[1]

Extensive interest was evident in the remarkable collection in the Copley Plaza Hotel from September 12 to 16 inclusive of articles, pictures, and literature relating to the rubber industry and including the era surrounding the time of Charles Goodyear's discovery of vulcanization. This display largely of the reminders of nineteenth century activities in rubber manufacture included a number of foreign contributions in addition to the many items gleaned from divergent sources within the United States. The photographs reproduced here and the enumeration by display units of the items exhibited, although not complete, is quite comprehensive and will indicate the general nature of the collection.

UNIT No. 1.—First Hancock masticator (see Figure 1) driven by a steam engine and installed in 1836 in the Coswell plant of the British Tyre & Rubber Co., London, England.

UNIT No. 2.—Photograph of the first steam engine (Grasshopper type—see Figure 2) used in rubber manufacture, built in 1836 by Easton & Amos and in the same year erected to run the Hancock masticator in the plant at 266 Coswell Road, London, E.C.1, England, of the British Tyre & Rubber Co. This engine was dismantled in 1922 after running more than 80 years.

UNIT No. 3.—Partial view of Thomas Hancock Exhibit (see Figure 3) by the British Tyre & Rubber Co., London, including units No. 1 to No. 3 inclusive—From left to right: pictures of Thomas Hancock (May 8, 1786-March 26, 1865), James Lyne Hancock (June 17, 1814-April 23, 1884), colored drawing of plant of Charles Macintosh & Co. in 1857, a picture of the first steam engine used in rubber manufacture, followed by the actual first steam-driven Hancock masticator. In the foreground is a case containing: a Marigold Automatic Closing (Tobacco) Pouch of red rubber probably made about 1851; two rubber mats with embossed flower design made in an early attempt to obtain artistic effects in rubber; a molded rubber plaque of Thomas Hancock prepared for the great exhibit in Hyde Park, London, England, May 1, 1851; a pair of native rubber boots (ankle high) representing the type of rubber purchased by Thomas Hancock for use in his manufacture; a frame containing specimens of early red-rubber molding and vulcanizing by Thomas Hancock (a series of four small designs in relief); and the following books or pamphlets, "Caoutchouc and Gutta Percha" published in 1852 by the Society for Promoting Christian Knowledge (England), "Caoutchouc and Gutta Percha" translated by T. Grant from the German of Raimond Hoffer in 1882, Dodd's "Curiosities of Industry" 1854, a list of all rubber patents leading up to Thomas Hancock's patent on Vulcanization (England) as published by Eyre & Spottswoods in 1859, "London Mechanics Register" Vol. 4 in 1826, "The Origin and Production of the Caoutchouc or India Rubber Manufacture in England" by Thomas Hancock in 1857, "The Repertory of Patent Inventions" No. 23 in 1844, an early vulcanizing temperature record showing a rise in temperature from 120 to 230 degrees between 6 p.m. and 5 a.m. (10 degrees every hour) and "hold here until cured," a compound book by James Lyne Hancock in 1877, a catalogue issued by James Lyne Hancock in 1867, the official catalogue of the 1851 exhibition in Hyde Park, London, the Cantor Lecture given by Thomas Bolas in 1880 on the subject "The India Rubber and Gutta Percha Industry," and Thomas Hancock's own copy of the first traceable illustrated trade price list of Charles Macintosh & Co. dated 1853.

At the right in the picture is shown a bust of Charles Goodyear, loaned by the New Haven (Conn., U.S.A.) Colony Historical Society.

[1] The INDIA RUBBER WORLD PHOTOGRAPHER obtained 20 pictures which cover practically the entire exhibit. For a limited time any one desiring prints of these photographs may obtain them at a nominal cost by contacting INDIA RUBBER WORLD or E. H. Krismann, Room 1412, 140 Federal St., Boston, Mass.

UNIT No. 4.—A table made from hard rubber under patents of Charles Goodyear for the exhibition by him at the Crystal Palace, London, in 1851 (see Figure 4).

UNIT No. 5.—Group photograph of Charles Goodyear and 18 contemporary inventors (see Figure 5).

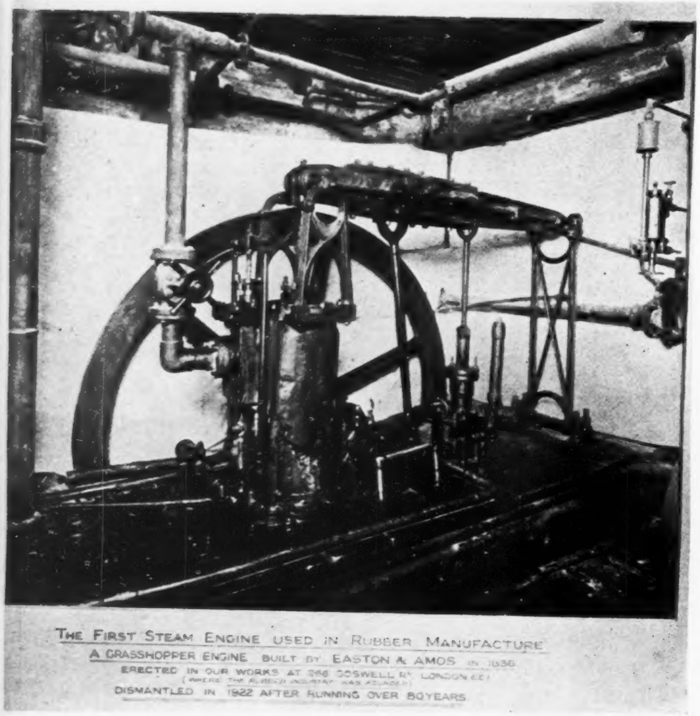
UNIT No. 6.—Photostatic copies of 35 pages from INDIA RUBBER WORLD 50 years ago.

UNIT No. 7.—Early Twentieth Century Miscellaneous Tires (see Figure 6): 1910—Airplane, 20x2 and 28x4; 1905—Carriage, 34x3 (solid); 1914—Truck, 40x8x4.5; 1915—Truck Fabric, 48x12; 1930—Industrial, 20x5x15 (solid). Several small automotive parts from the same period are shown.

UNIT No. 8.—Early Twentieth Century Passenger Car Tires (see Figure 7): 1909—QD CL Fabric, 35x4.5 (2-cure); 1912 to 1918—Fabric, 33x4, and H.D. Cord, 34x4; 1914—Bolted on Fabric 36x4.5; 1915—RL Tread 34x3.5; 1916—Fabric, 32x4, and S.S. Fabric (2-cure), 35x5; 1917—PL. Tread, 36x4.5, and S.S. Fabric, 35x4.5; 1918—PL. S.S. Fabric, 32x3.5; 1929—Clincher Cord 30x3.5, and S.S. Cord, 21x4.40; 1931—Cord, 30x3.5.

UNIT No. 9.—Modern Tires (see Figure 8): 1912-1916—Hook Construction Cord 32x4.5, one passenger-car balloon for each of 15 companies, and in the background, a 1928 solid truck tire, 36x8, and a present-day balloon truck, 18.00x24, with a 2.00x8 for comparison.

UNIT No. 10.—Specimens of Crude, Synthetic, and Specially Prepared Rubbers (see Figure 9): Left—*Hevea* Latex, Coagulated Latex, Pale Crepe, Smoked Sheet, Fine Hard Para, Coarse Para, African, Knockry (African), Guinea (African), Mixed Pickle, Guayule, Gutta Percha, Gutta Siak, and Balata; Right—Powdered Rubber, Crumb Rubber, Deproteinized Rubber, Latex Sprayed Rubber, Perbunan, Neoprene (E, G, and Latex), Thiokol (D,



(Top, Left)
Fig. 1

(Center)
Fig. 2

(Left)
Fig. 3

(Top, Right)
Fig. 4

Fig. 5

DR. MORTON Etherization — COLT Revolvers — SAXTON Mint & Coast Sury. Machinery — PETER COOPER Gelatine — PROF. HENRY Electricity as a Motor — DR. NOTT Management of Heat — SICKLES Steam Cut-Off — BURDEN Horse Shoe Machine — BIGELOW Carpet Loom — BLANCHARD Electric Lathe

BOGARDUS Iron Architecture — McCORMICK Reapers — GOODYEAR Vulcanizing Gum Elastic — MOTT Works in Iron, Fuel — ERICSSON Caloric Engine, Monitors — MORSE Electric Telegraph — HOE Rotary Press — JENNINGS Friction Matches — HOWE Sewing Machine

K, Latex, and Molding Powder), and Tournesit.

UNIT No. 11.—Compounding Ingredients and Reclaimed Rubber (see Figure 10).

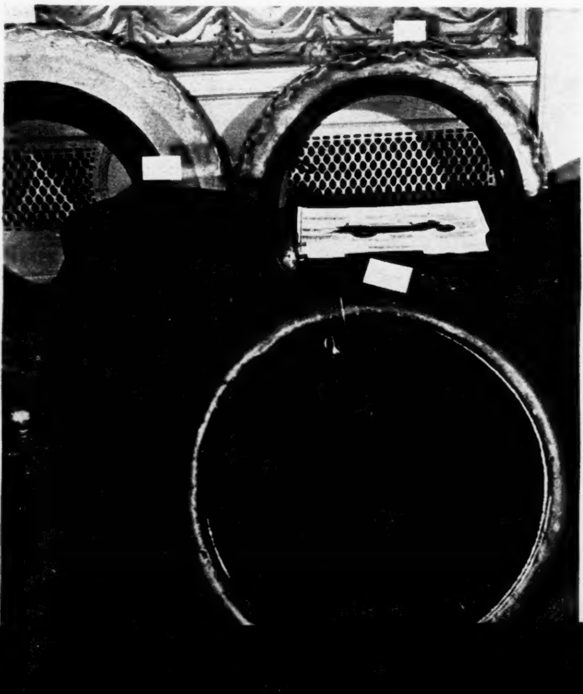
UNIT No. 12.—Mechanical Rubber Goods (see Figure 11) including: Rubber Covered Wires and Cables, 50 specimens; Hose and Tubing 24; Belts, 10; Matting, 2; and Synthetic Rubber Products, 13.

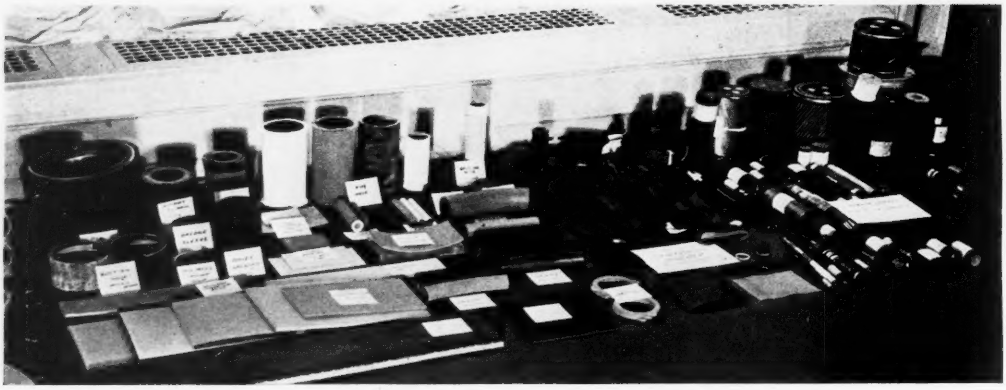
UNIT No. 13.—Modern Rubber Footwear Display (see Figure 12) includes four typical Boots, one Hunting Pac, five Gaiters, four Rubber Overshoes, seven Canvas Shoes, and one Sandal.

UNIT No. 14.—Old Rubber Boots—Men's Boot purchased in 1891 from Hartman & Everest, Glens Falls, N. Y., and in use up to five years ago; Hood Brand Hip produced in 1898; Wales-Goodyear Sporting early 1900 (date not definite); Goodyear Glove Brand Short and Hip Boots made in 1902; Woonsocket Firefighter Short Boot originally purchased in 1905; and Goodyear Glove Fireman's Short Boot purchased July 10, 1914.

UNIT No. 15.—Case (see Figure 13) displaying: the book "Trials of an Inventor—Life and Discoveries of Charles Goodyear," 1866; a compound Book of Billings, Clapp & Co., Chemists, 144 High St., Boston, Mass., dated July 25, 1899; and license papers "Charles Goodyear Esquire to William Judson Esquire dated 4th August 1856 License under letters patent dated 30th January 1844 so far as relates to Boots and Shoes and coverings for the feet;" License William Judson Esq. to Christ Meyer Esq. and others dated Ninth August 1856, and a letter from William Judson dated Edinburgh 26 Sept. 1857 to North British Rubber Co. granting "license to make and sell shoes and boots without any stamp or mark

(Left), Fig. 6; *(Above)*, Fig. 7; *(Below)*, Fig. 8





(Top), Fig. 9; (Center), Fig. 10; (Above), Fig. 11

of Patentee."

UNIT No. 16.—Old Rubber Footwear—Wales Goodyear Shoe Co. gum shoes found in a New Haven store, May 7, 1931, and known to have been in stock for over 45 years; Lyconing Rubber Co. gum shoes (found as above) in stock from 30 to 35 years before May 7, 1931; Goodyear Boot & Shoe Co. gum shoes (found as above) in stock over 45 years before May 7, 1931; American Rubber Co. Short Boots purchased by J. Howard Johnson 41 years ago; Hood Molded Marvel Overshoe (men's) made in the 1890's; Women's Boot made about 1860; Worn Gum Shoes illustrative of those made from 1800 to 1850 (loaned by E. G. Burgum, Concord, N. H.); Women's Imitation Sandal made about 1870; Meyer Rubber Co. Child's gum shoes, Goodyear Process Patented Feb. 21, 1871, made about 1871 to 1875; Goodyear Glove Women's Zephyr Petites (Regular Narrow Last) made in the Fall of 1893; Illustrative Women's Russian Boot which preceded the Zipper Pavlova; and a native rubber shoe (loaned by Mr. Astlett).

UNIT No. 17.—Assembled display of 63 specimens of miniature rubber footwear (see Figure 14), "Original Display as Shown at Columbian Exposition, Chicago, 1893."

UNIT No. 18.—Leather, Wood, and Rubber Shoe Collection (United Shoe Machinery Corp., Boston, Mass.) Representing Many Countries:

England—Lancashire clog with wooden sole and heavy leather upper: sole protected with armored band on forepart, and heel and upper tacked to wooden sole with brass tacks. Still made in large quantities in the Lancashire district of England. Purchased in London, Ont., Canada, in 1922. Old English patten (Iron Circular Stilt, Wood Base, Leather Straps): probably in the period 1825-1850. Has wrought-iron stilted sole raising the foot above the damp earth. Purchased in England in 1898 by a New York collector and from him for the collection in 1928.

United States—Patten (leather) once worn by Mrs. Lucy Lea Prescott, of Epping, New Hampshire, about 1800. Well made and has seen much service. Presented by a descendant of the wearer, Mrs. C. T. Cahill in January, 1929. Hinged wooden patten with leather upper. Forepart so hinged as to make it more comfortable in walking. This patten was worn by the grandmother of Mrs. E. W. Crafts, of Grass Lake, Mich., prior to 1830-1850. Purchased from Mrs. Crafts in 1927. Child's rubber overshoe made about 1885. Presented to the collection by Charles Swan, son of the late Daniel Swan, a well-known shoe dealer and manufacturer of Lowell, Mass. Men's galosh or sandal made of treated leather intended to be worn in damp weather. Made by Robbins, a New York shoemaker in 1835. Purchased in New York in 1914.

Brazil—Very old gum shoe (folds flat with lengthwise crease in center of sole and upper) of the type originally made in the forests of Brazil by natives. Made by forming a clay last, dipping it into latex, smoking it, and afterward setting it out in the sun to cure. The clay last was then crumbled out from the shoe, which was then stuffed with rice hulls to prevent it from adhering. This shoe was presented to the collection in 1910 by Charles Swan,

(Right) Fig. 12

(Below) Fig. 13

in whose father's possession it had been since 1850. Despite all the years the rubber still maintains an average amount of elasticity. Another very old gum shoe made by natives of Brazil about 1840 was owned by Daniel Swan for about 55 years previous to presentation to the collection by his son in 1904. Shaped to approximate the foot and with an outline of a leafy design on the toe, it was made according to the usual native custom and some of the rice hulls were in the shoe at the time it was presented.

Bolivia—Gum shoe of the type still made in some sections of Bolivia and worn by natives. Made in the primitive method of forming a last of clay, dipping into latex, smoking it, curing and finally crumbling out the clay last. It is unusual because of the thickness of the rubber (approximately ¼-inch thick — horizontal top — ankle high). Effort has been made to work in outline the seams and to give the appearance of nails in the sole. Purchased in Potosi in 1931.

Greenland—Unusual boot (bear skin upper) worn by one of the most northern families of Polar Eskimos. About 14 inches high at the back and 18 inches at the front, it is made from the foreleg and foot of the polar bear; the forelegs only are used as the hair grows in such a manner as to shed snow or moisture. The sole is of square flipper seal. Usually worn with stockings made from the polar hare or Caribou skin when available. A sealskin thong at the top gathers the boot tightly around the leg in order to keep out moisture or snow.

Japan—Finely made clog with sole pad of plaited palm fiber on wood base and cloth upper. Purchased in Tokio in 1904.

Holland—Old Dutch klompen (all wood) which from the wood and evident amount of wear appear to have seen considerable service. Purchased from a New York collector in 1928.

Peru—Crude native shoe of rubber made in the same manner as the original gum shoes. Shoes of this character were made in the early part of the last century in the interior of South America for export. Presented to collection in 1921.

Unit No. 19.—Display of Early Products and Records including: Hard rubber whiskey flask presented to a Union Army officer by his friends in Naugatuck in the late months of the Civil War. (Loaned by A. G. Emery, Naugatuck, Conn.)

Rubber tired roller skates bearing molded inscription, "Goodyear Patent 1844-58." (Loaned by A. A. Benedict, New York, N. Y.)

Six original compound books with indication of origin in late nineteenth and early twentieth centuries. Typical pages in ink in long hand bore the following information.

Hard Rubber Tyre Compounds (Used during Early 1900s)

	#1	#2	#3—Syringe Pipes
Para	10	5	9
Accra	..	6	..
H R Dust	5	15	18
Sulphur	6	6½	9¼
Cotton Seed Oil	½	2	..
Shellac	..	..	7½
Beeswax	..	..	½

No. 1, 2 and 3 cure at 300°
9 hr. run up
7 hr. hold

Compounds for Hospital Sheeting
[No date—probably early 1900s]

4 lbs.	Rubber		Acid Cure
4 "	Pontiac	5 lbs.	Fine
25 "	Lithopone	4 "	Pontiac
25 "	Paris White	25 "	Grasselli White
1 "	Cotton Seed Oil	25 "	Paris "
8 oz.	Magnesia	1 "	Cotton Seed Oil
8 oz.	Sulphur	8 oz.	Magnesia
1 lb.	White Lead		

Unit No. 20.—Sixty-two original United States Government patent models relating to rubber which accompanied applications for patents in the nineteenth century. (See Figures 15 and 16. Loaned by American Patent Models, Inc., New York, N. Y.)

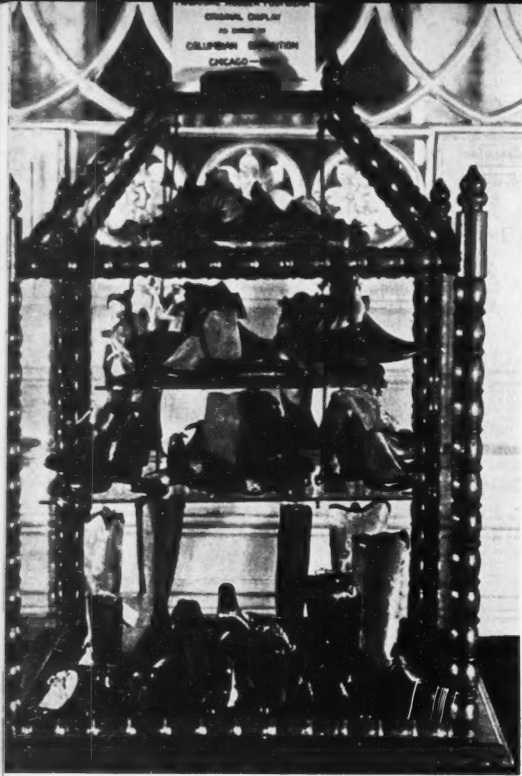
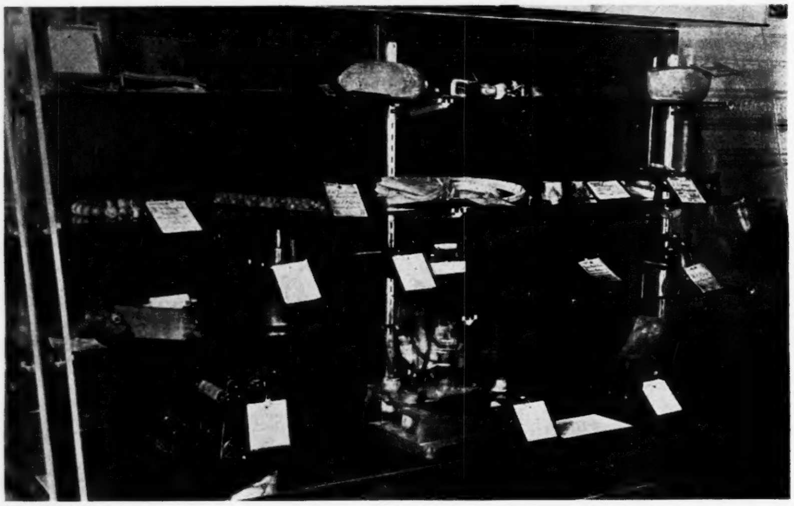


Fig. 14

Fig. 15



(Right) Fig. 16

This exhibit was made possible through the courtesy and cooperation of the individuals and companies who, having accumulated the articles, so generously loaned them for the duration of the meeting. Evident contributors include: American Patent Models, Inc.; Armstrong Rubber Co., Inc.; Mr. Astlett; Bell Telephone Laboratories; A. A. Benedict; Boston Woven Hose & Rubber Co.; British Tyre & Rubber Co., Ltd.; E. G. Burgum, Cambridge Rubber Co.; Corduroy Rubber Co.; Diamond Rubber Co.; Dunlop Tire & Rubber Co.; A. G. Emery; Firestone Tire & Rubber Co.; Fisk Rubber Corp.; General Tire & Rubber Co.; B. F. Goodrich Co.; Goodyear Tire & Rubber Co.; Hood Rubber Co.; INDIA RUBBER WORLD; Kelly-Springfield Tire Co.; Lambertville Rubber Co.; Lee Tire & Rubber Co.; McCreary Tire & Rubber Co.; Mohawk Rubber Co.; Naugatuck Chemical Div., United States Rubber Co.; New Haven Colony Historical Society; Pharis Tire & Rubber Co.; Pennsylvania Rubber Co. of America, Inc.; Servus Rubber Co.; Simplex Wire & Cable Co.; United Shoe Machinery Corp.; and United States Rubber Co.

"Credit Where Credit Is Due"

The entire meeting of the Division of Rubber Chemistry, including the banquet and the general session in which the entire American Chemical Society participated, was conducted with a dignity and an apparent standard of performance such as exemplify a full realization of the importance of the occasion and the function which present-day members of the industry perform in national life. There was evidence of hard work and careful planning on the part of not only those who cooperated in the arrangements for the meeting, but also by the authors of papers and the speakers at the general session and the banquet. Also a spirit of enthusiasm and serious attention to the subject matter under discussion was displayed by those attending. The banquet was made possible by the generous and enthusiastic support of 72 rubber companies and suppliers associated with the rubber industry. A large measure of satisfaction should accrue to those who supported the celebration, to those who loaned articles to the rubber exhibit, and to the unofficial workers who assisted in the arrangements as well as to the Centennial Committee consisting of C. R. Boggs, A. A. Somerville, W. B. Wiegand, John M. Bierer (chairman), and to the Exhibit and Decoration Committee composed of T. M. Knowland, J. C. Walton, A. A. Glidden, D. C. Scott, Sr., E. L. Hanna, J. J. Sindler, W. E. Kavenagh, and E. H. Krismann, (chairman).

Columbia to Release Goodyear Film

On October 6, Columbia Pictures Corp. will release for general distribution "The Story of Charles Goodyear," a motion picture depicting the life and struggles of this great inventor. The film is one of a series on famous inventors. Jan LeMan, director and author of the script, spent considerable time studying old volumes and many rare, unprinted manuscripts to gather additional information on this dramatic story. Hal Taliaferro plays the title role; while Lorna Gray plays the part of Mrs. Goodyear in the production.

A Half Century of Association of Which INDIA RUBBER WORLD Is Very Proud

REPRODUCED herewith are six advertisements appearing in the first issue of INDIA RUBBER WORLD, which have remained in our columns in one form or another since 1889.

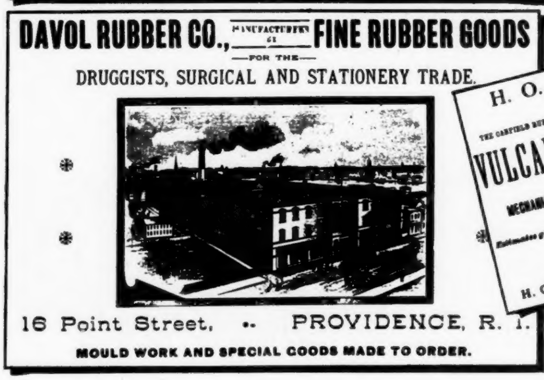
The H. O. Canfield Co., the Davol Rubber Co., the Home Rubber Co., and John Royle & Sons are still operating under their original names, while the Birmingham Iron Foundry is now a part of Farrel-Birmingham Co., Inc., and the Boomer & Boschert Press Co. is today known as the Dunning & Boschert Press Co., Inc.

In addition to those named above, two of our regular advertisers have been in the paper regularly for over 40 years, five for over 30 years, 19 for over 20 years, and 11 for over 15 years.

It reflects credit on both the prestige of the publication and the stability of the industry that has made this record possible. Starting only 50 years after the discovery of the principle of vulcanization by Goodyear, INDIA RUBBER WORLD, through both its editorial and advertising pages has reflected and recorded the progress of the industry in improved processes, materials, and equipment.

It is a far cry from the mills, presses, and extruders of a half century ago to the automatic vulcanizers and presses of today; yet the pages of INDIA RUBBER WORLD have chronicled this progress through every step. Its files and indexes represent rubber history in every stage of its making.

Looking ahead, it might be interesting to observe how rubber men of 1989 will consider the processes and equipment of today as compared with the current and, undoubtedly, highly improved methods of 50 years hence.



UNITED STATES

The "Ekko" Process for Making Molds Introduced by U. S. Rubber Co.

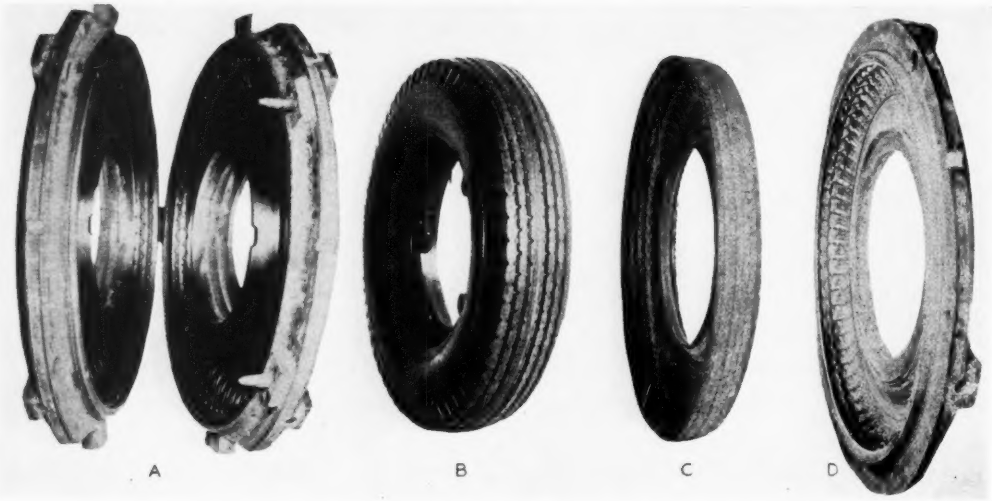


Fig. 1. Steps in the Production of Tire Molds by the "Ekko" Process

THE "Ekko" process is a new method for the preparation of molds and dies which grew out of researches by the United States Rubber Co., 1790 Broadway, New York, N. Y., on the production of cheaper tire molds. The name "Ekko" is a phonetic spelling of echo suggestive of the duplicating nature of the process. The new method is said to offer advantages to almost all industries using molds and dies and to permit complex designs.

The Process

The "Ekko" process enables the production of molds and dies from an original article or a specially prepared pattern by electroforming a deposit of iron on the desired pattern. Electroforming is essentially the same as electroplating except that deposits up to ½-inch thick can be produced, whereas from 1/1000 to 2/1000-inch of metal is applied by the usual electroplating processes. When heavy electroformed deposits of iron are separated from the underlying pattern, a cavity or die insert is obtained which is a negative reproduction in minute detail of the shape and surface finish of the pattern.

The iron produced by the electroforming process is 99.98% pure and substantially free from porosity. When plated, it is about 50% harder than cold rolled steel and gives a scleroscope reading of 37 or a Brinell reading of 240. The metal can be softened to the normal value of pure iron by annealing or can be hardened by carburizing so that it will scratch glass. Electrolytic iron has a heat conductivity nearly twice that of cast-iron or steel.

Patterns upon which to deposit the iron should have a conductive surface. Non-conductive materials such as rubber, wood, glass, and plastics may be used provided the surface is first made conductive. In the case of rubber patterns, this condition is achieved by dusting the surface with powdered graphite and polishing with a light brush. Any metal is satisfactory for pattern use with the exception of zinc and aluminum, which are attacked by the plating bath.

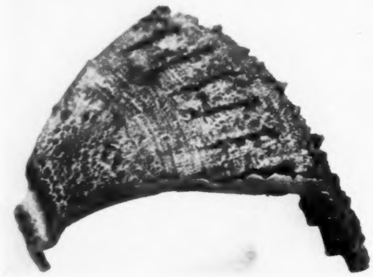


Fig. 2. Segment of an Electroformed Tire Mold

Tire Molds

The steps in the process of preparing tire molds are shown in Figure 1. A is a mold made by the usual process of engraving mounted in a cast-iron watch-case back. This mold which is said to require at least 165 man-hours of labor to produce, is used to produce the rubber pattern, B, which is later covered with iron by electrodeposition. A spacer ring between the mold sections is used in molding the pattern to allow extra width in the central tread portion, thus providing extra material where the unit is to be cut into halves. C is one-half of an electroformed cavity ⅜-inch thick. This shell, which weighs about 100 pounds, is fitted into a watch-case back as shown in D and is held in place at a few points by welding. Figure 2 shows the outer surface of a segment of an electroformed tire mold.

Other Types of Molds

One of the first applications of the "Ekko" process to other than tire molds was the preparation of a sponge rubber hand for a young girl. The success with this project indicated the desirability of electroforming in the rubber industry. An example of the intricate mold designs that can be produced by the process is illustrated in Figure 3, which shows the molded rubber design on the right and the mold itself on the left. In addition the "Ekko" process has found application in the plastics, glass, embossing, and metal stamping fields.

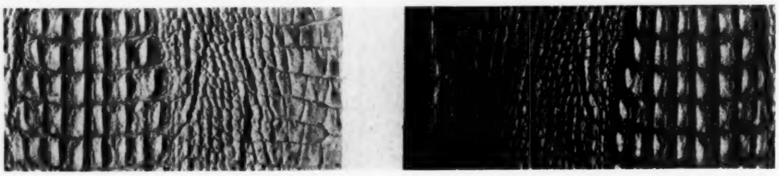


Fig. 3. Electroformed Mold Segment (*Left*) and Molded Reproduction in Rubber (*Right*)

Ample Rubber and Replacement Materials Appear to Be Available

WITH present world conditions becoming more complex there is much speculation as to the effects upon the American rubber industry and, in fact, upon the commerce in rubber and rubber products throughout the world. The indeterminate factors are too numerous to enable any accurate prognostication regarding the ultimate resulting conditions. In attempting to conduct business on a suitable basis many are looking back at the situation in 1914 and examining the trend during the four-year period which ended with the termination of the war in 1918. However present conditions which will affect the rubber industry in the United States during the period of this European war are definitely at variance with those existing in 1914.

Demand in 1914 and 1939

At that time rubber goods were being manufactured to a considerable extent in only a dozen countries, and the export of rubber products was largely conducted by Great Britain and Germany with the United States, Russia, France, Italy, Canada, and Belgium appearing as lesser factors. In the early days of the war many of these countries became involved, and because of the increased internal demand they were unable to continue supplying the export requirements. As the result, a rapid and unanticipated demand was made principally on the United States and Canada to supply not only the excess of normal export needs, but also the increase in industrial requirements because of activities caused by the war as well as tires for the then rapidly expanding automobile industry. Thus a very exceptional situation was created wherein the American rubber industry, which was of much lower volume than at present, was called upon to accommodate a rapidly expanding field and also the war requirements, thus resulting in a virtual boom in the industry.

Today conditions are very much changed. Rubber goods are being produced regularly in a greater number of countries for domestic use and many of these are practically self sufficient. International trade has not increased in proportion to world consumption. The American rubber industry is now of much greater magnitude, has available a greater excess capacity, and therefore can absorb more additional business than in 1914. Undoubtedly there will be some increased demand due to both domestic and foreign needs, but the percentage of the increase to the capacity is likely to be of considerably lesser proportions than during 1914 to 1918.

Rubber Supply in 1914 and 1939

The situation regarding the available supply of the basic material, rubber, is much more favorable than in 1914 and the four years which followed, when plantation rubber was only becoming a factor. There was no excess capacity for producing crude rubber, or were surplus stocks of the commodity available in either the consuming or producing countries at that time. Synthetic rubber-like materials were unheard of and reclaimed rubber was more or less limited primarily because the available scrap from old tires had not reached sizable proportions.

The annual world capacity for producing natural crude rubber is now approximately 50% greater than the yearly world consumption. On July 1, 1939, the world stocks consisted of 5.4 months' world supply. Although on September 1, 1939, the United States had only approximately 3½ months' supply, arrangements have been made whereby the government will procure in the future an impounded additional stock of about 80,000 long tons, or at the present rate of consumption 1.6 months' supply, which is to be held by government agencies for use only in case of a war emergency. According to a cable received on September 7 by the New York Commodity Exchange from London through Reuters, it was officially announced that for the purpose of buying rubber for shipment to New York and other ports in the United States pursuant to the Anglo-American barter agreement, the Ministry of Supply is opening a market office. Although the date of instituting buying was not announced, there is definite evidence of the intention to proceed with the plan. According to another cable to the Commodity Exchange on September 9 from London through Reuters, the International Rubber Regulation Committee has revised the permissible quota for the fourth quarter of 1939 to 70% of basic quotas. Although at least part of this quota is probably intended to compensate for the barter plan, the I.R.R.C. has shown its intention to take the necessary action to provide more crude rubber. Assuming that rubber is available, the only source of interruption lies in decreased shipping facilities.

After communicating with the American Government, The Rubber Manufacturers Association, Inc., on September 12 issued a statement indicating that ample rubber is available to supply all conceivable demands in war time and further stated: "As for shipping, there is substantial evidence that adequate shipping is available and that it will continue to be provided regardless of adjustments of routes and lines. The U. S. Maritime Commission has expressed its willingness and its ability to give aid if necessary."

Synthetic Materials

Synthetic rubber-like materials including Neoprene, "Thiokol," Koroseal, etc., have heretofore been utilized primarily in products subjected in service to heat, oil, or other conditions to which natural rubber is not suitably resistant, but tests have been made which indicate the possibility of practical substitution of these materials for crude rubber to a much larger extent should a shortage of crude exist or if the prices were to become more nearly equalized. Any tendency in this direction would result in larger scale production of synthetic materials and consequently lower costs. Information is gradually being obtained regarding the scope and technique of their use. The raw materials needed are found within the United States in ample quantities for any possible requirements. Processes and manufacturing methods have been perfected. In the event that the major portion of the crude rubber supply were suddenly cut off, it would, of course, be impossible immediately to provide a sufficient replacement quantity of the synthetic products, as production capacity for such an emergency is not now available, but the existing capacity is reported to be well ahead of actual consumption requirements and as being gradually enlarged when the need is indicated. Further increases in capacity are limited only by the time required to provide the plant and equipment. In addition to the synthetic rubber-like materials now produced commercially in this country, a process has recently been developed whereby a synthetic rubber of the Buna type is said to be producible from raw materials now abundant here. It appears very likely that production at a reasonable cost could be instituted within a comparatively short time.

Reclaimed Rubber

Reclaimed rubber as a class of materials is a very tangible medium for relieving the situation which would result from a shortage of crude rubber. Having been produced and used on an important scale in rubber compounding throughout the past four decades, it is fully understood and requires no new technique in its use. Enormous quantities of worn tire carcasses, tubes, and other scrap materials are procurable for the production of reclaimed rubber. With the present improved processes of reclaiming, the materials produced are now being utilized in many quality products including tire carcasses as well as footwear and numerous mechanical rubber goods. Since the price of tube reclaim ranges from 9 to 10 cents per pound and black select tire reclaim stands at 6¢, or less than one third of the price of crude, the substitution of reclaimed rubber is not contingent upon a phenomenal rise in the price of crude rubber.

In 1917 with the United States crude rubber consumption at 157,371 long tons and the price of crude at $0.722 per pound, the consumption ratio of reclaim to crude was 56.7%. In 1922 with crude consumption at 283,271 long tons and price at $0.174 per pound, the consumption ratio of reclaim to crude was 19.2%. In 1928 with crude consumption at 437,000 long tons and

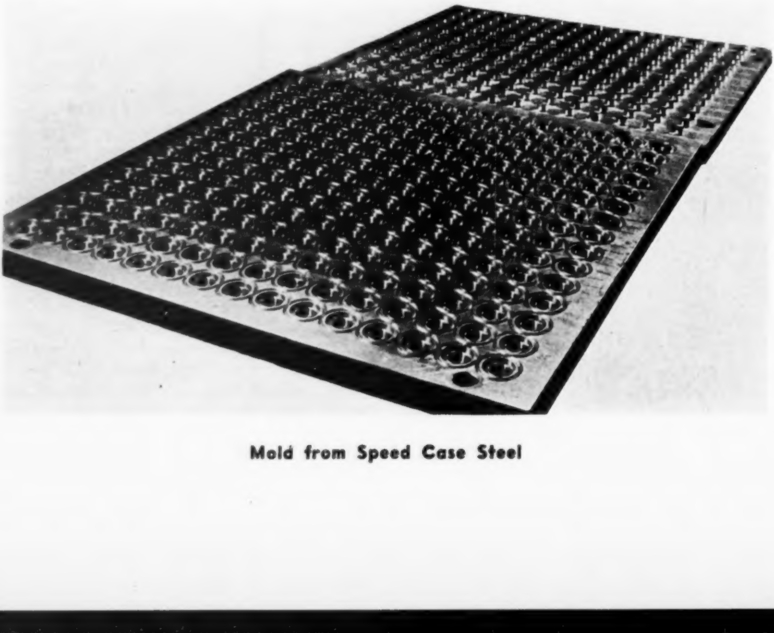
price at $0.223 per pound, the consumption ratio of reclaim to crude was 51%. In 1937 with crude consumption at 543,600 long tons and price at $0.194 per pound, the consumption ratio of reclaim to crude was 29.8%. In 1928 the total of the United States consumption of reclaim plus the net exports, or presumably the actual production of reclaim, was 232,416 long tons. According to a report issued on June 17, 1937, by the Leather and Rubber Division, Bureau of Foreign and Domestic Commerce, of its survey covering 28 companies operating 33 reclaiming plants, the potential annual capacity, on the basis of 6 days of 24 hours each per week, was indicated to be 220,600 long tons and, when allowing for planned extensions, was expected to be 253,900 long tons by January 1, 1938. It need be remembered that this is "potential" capacity and that sustained production could not be held at 100%, but on the other hand a seven-day week would probably maintain the total annual capacity of approximately 250,000 long tons on the basis of planned expansion by January 1, 1938. It has recently been said that the capacity for producing reclaimed rubber in the United States now stands at 265,000 long tons, or from 50 to 55% of the nation's total consumption of crude rubber last year in contrast to the present ratio of approximately 33%.

Suppliers Report Liberal Capacity

When the probable excess demand over normal requirements and the potential supply of crude rubber, synthetic materials, and reclaimed rubber is fully considered, it appears that ample facilities are available to accommodate any possible load which may be thrown on the rubber industry. This is based, of course, on the assumption that rubber companies will place orders only on the basis of the proper inventory for their actual needs. There has been some evidence of what appears to be an unwarranted building of inventory of these raw materials for emergency purposes. A sudden rush for unneeded materials will disrupt the markets and production schedules of suppliers who report ample capacity to care for actual needs. Hysteria in buying should be avoided.

Holliday & Co. Features Speed Case Mold Plates

Molds for rubber goods are now being made from Speed Case plates, open-hearth steel plates of high uniform quality. The steel is available in three carbon grades—.15/.25 c., .30/.40 c., and .45/.55 c.—which generally cover mold requirements. The plates are said to produce a smooth bright finish with no tendency toward tearing at the highest machining speeds. Important economies are claimed in mold production because in many cases the machined surface is the finished surface, and no subsequent operation is necessary. Speed Case plates are also said to be more resistant to wear and corrosion than ordinary steels generally used in the same application. W. J. Holliday & Co., 228 N. La Salle St., Chicago, Ill.



Mold from Speed Case Steel

Robertson Resigns; Collyer Goodrich Head

David M. Goodrich, chairman of the board, The B. F. Goodrich Co., Akron, O., announced that at a directors' meeting in New York, N. Y., on September 12 the board had accepted with regret the resignation of President S. B. Robertson, who had recently completed 20 years' service with the company. His successor, elected the same day, is John Lyon Collyer, who resigned as joint managing director of the Dunlop Rubber Co., Ltd., Fort Dunlop, England, to accept the Goodrich post. He will return to the United States within a few weeks.

Mr. Collyer was born at Chelsea-on-Hudson 45 years ago. Graduated from Cornell University in 1917 as a mechanical engineer, he immediately joined the Bethlehem Shipbuilding Co. and later entered the rubber industry with the Dunlop Tire & Rubber Co., Buffalo, N. Y., serving as vice president from 1923 to 1929. That year Dunlop Co., Ltd., made Mr. Collyer works director of its plant at Fort Dunlop, England. In 1931 he was appointed controller of manufacture at the Dunlop headquarters, and in 1936 he joined the board with responsibility for the direction of the company's manufacturing operations throughout the world. In 1937 Mr. Collyer was made joint managing director of Dunlop.

John Lyon Collyer

Goodyear to Build New Mechanicals Plant

The Goodyear Tire & Rubber Co., Akron, O., is erecting a new mechanical rubber goods plant in St. Marys, O., which is expected to be in production about January 1. The plant and equipment will represent an investment of approximately $1,000,000. The factory structure, of the modern single-story type, will measure 100 feet by 500 feet; it is to be located on 60 acres of land acquired for the purpose by Goodyear. When full scale production is attained, it is expected that the new plant will employ 400 persons. The St. Marys location provides adequate room for future expansion of the plant.

New Subsidiary for Export Operations

Owing to the increased number and volume of manufacturing operations outside the United States, Goodyear Foreign Operations, Inc., was incorporated, to be responsible for overseeing the operations of production, distribution, and operating of all Goodyear business outside the U. S.

Officers of this new subsidiary follow: P. W. Litchfield, president; E. J. Thomas, executive vice president; A. G. Cameron, vice president; Z. C. Oseland, treasurer; R. B. Howard, assistant treasurer; W. D. Shilts, secretary; C. A. Failing, assistant secretary; C. L. Weberg, comptroller; H. L. Riddle, Jr., assistant comptroller; G. K. Hinshaw, production manager.

(Continued on page 110)

Editor's Book Table

BOOK REVIEWS

"Rubber Red Book." Published by *The Rubber Age*, 250 W. 57th St., New York, N. Y. 6 by 9 inches, 422 pages. Price, paper, $4; cloth, $5.

This biennial directory for the rubber industry and its suppliers has been revised, brought up to date, and, through the inclusion of four new sections, has been materially extended in scope. The rubber bibliography section included in the previous edition has been omitted as this compilation is now published separately. In those sections continued from the previous edition the 1939 directory contains data on the following: rubber manufacturers in the United States classified alphabetically and according to product and geographical location; Canadian rubber manufacturers; rubber machinery and equipment and their manufacturers; rubber chemicals and compounding materials and their suppliers, including a list of trade and brand names; fabrics and textiles; crude rubber dealers, agents, and brokers; reclaimed rubber manufacturers; scrap rubber dealers; latex and latex compounding materials and equipment; consulting technologists; etc. Sections new to this edition cover: sales agents and suppliers' branch offices; technical journals; technical and trade organizations; and a "Who's Who in the Rubber Industry."

The extensive amount of data which has been carefully compiled and arranged in this volume will continue to provide an essential and valuable reference service to the rubber trade.

"Handbook of Chemistry." Third Edition. Compiled and edited by Norbert A. Lange. Assisted by Gordon M. Forker. An appendix of Mathematical Tables and Formulas by Richard S. Burington. Published by Handbook Publishers, Inc., Sandusky, O. 1939. Fabrikoid, 5⅜ by 7¾ inches, 1850 pages. Indexed. Price $6.

The third edition of this handbook retains the general characteristics of the previous edition. None of the tables in the previous edition has been eliminated although a number of them have been entirely rewritten to incorporate more recent information. In addition six new tables have been added. An important innovation in this edition is the inclusion of new material of a nature intended to make the whole work self-explanatory. Thus the section on definitions has been extended to include a definition of all column headings and technical terms used throughout the handbook. As a further aid toward clarity, a table of the commonly accepted thermo- and physico-chemical symbols and a table of dimensional formulas have been added.

"Standard Chemical and Technical Dictionary." H. Bennett. Published by The Chemical Publishing Co., Inc., 148 Lafayette St., New York, N. Y. 1939. Cloth, 6 by 9 inches, 638 pages. Price $10.

This compilation of over 25,000 concise definitions is a condensed word book for students, writers, technicians, engineers, scientists, and others who need assistance in keeping up with the many new technical words of expression. The dictionary covers industrial products, chemicals and trade names, abbreviations, and contractions, as well as the symbols used in mathematics, chemistry, thermodynamics, etc. A special section is devoted to the nomenclature of organic compounds.

"Industrial Solvents." Ibert Mellan. Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y. 1939. Cloth, 6 by 9 inches, 480 pages. Author and subject indexes. Price $11.

Extensive data on solvents which have been accumulating in scattered literature for years have been analyzed, correlated, and brought together in comprehensive form within the pages of this volume. The inclusion of a large number of graphs and tables affords a rapid means of obtaining specific and comparative information. The introductory chapters treat the theoretical aspects, covering such subjects as: solution, plasticity, viscosity, vapor pressure, and evaporation rates. Subsequent chapters deal with industrial applications and individual solvents grouped chemically as follows: hydrocarbons and their hydrogenated derivatives, halogenated hydrocarbons, alcohols, aldehydes, acids, ketones, ethers, esters, and nitroparaffins. Plasticizers are given individual treatment in a separate chapter. Several brief references in the text are made to the use of solvents for crude and chlorinated rubber and in reclaiming.

"The Raman Effect and Its Chemical Applications." James H. Hibben. American Chemical Society Monograph No. 80. Published by the Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y. 1939. Cloth, 6 by 9 inches, 544 pages. Price $11.

The Raman effect, which is essentially another means by which the behavior of atoms may be measured independently of the state of aggregation, has found applicability to both physics and chemistry and has contributed largely to the understanding of molecular constitution and molecular behavior. To describe in detail how this has been accomplished is the purpose of this book. The treatment of the subject is divided into three parts: Part I deals with the nature of the Raman effect, its relation to other physical manifestations, and the vibrations and rotations of polyatomic molecules; Part II deals with the application of those principles to organic chemistry; Part III deals with their application to inorganic chemistry. Brief mention is made to the work on the Raman spectra of rubber, balata, isoprene, chloroprene, and polychloroprene. In regard to these substances, the Raman spectra is shown to be useful as a tool to study the mechanism of polymerization.

NEW PUBLICATIONS

"The Vanderbilt News." September-October, 1939. R. T. Vanderbilt Co., 230 Park Ave., New York, N. Y. 24 pages. The first half of this issue of the "News" is devoted to a discussion of Tysonite, an organic, rubber-like plastic designed for use in rubber compounds to resist the deteriorating effect of ozone. Other articles deal with: a comparison of ⅛-inch and ¼-inch dumbbell specimens in the tensile testing of pure gum stocks; Ethyl Zimate in latex dipped goods; suggestions for storing and handling latex in the factory; and determining the volume increase of vulcanized rubber in solvents.

"Rubber in Chemical Engineering." H. P. Stevens and M. B. Donald. Reprint edition issued by the British Rubber Publicity Association, 19 Fenchurch St., London, E.C.3, England. 58 pages. This booklet, which originally appeared in 1933, was reprinted in June, 1939, owing to the large demand for copies. The subject matter deals with the properties and chemical resistance of rubber; rubber linings for tanks and similar equipment; rubber paints, cements, etc. Copies may be obtained upon request to G. S. Cook, Secretary, The British Rubber Publicity Association.

"Rubber Research Scheme (Ceylon)." Second Quarterly Circular for 1939. London Advisory Committee for Rubber Research (Ceylon and Malaya), Imperial Institute, South Kensington, London, S.W.7, England. 65 pages. This circular contains four articles on plantation problems dealing with a comparison of tapping systems, the performance of imported clones in Ceylon, *Oidium* leaf disease in Ceylon in 1939, and identification of clones on Ceylon estates. A fifth article discusses synthetic substitutes for rubber.

"Wide Base Tires and Rims for Agricultural Tractors." July 21, 1939. Supplement of "1939 Year Book," The Tire & Rim Association, Inc., Akron, O. 4 pages. This supplement on wide base tires and rims for tractors contains three tables: load and inflation; recommended rims; and basic cross-sectional limits. Diagrams show rim contours and air-water valves for these tires.

"Life, Service and Cost of Service of Pneumatic Tractor Tires." Eugene G.

McKibben and J. Brownlee Davidson. Bulletin 382. Agricultural Experiment Station, Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa. 24 pages. This bulletin contains a report on the experience of Iowa farm users of 199 sets of pneumatic tractor tires. The combined experience which represents the equivalent of 381 years of individual observation indicates satisfactory durability and field performance of these tires.

"Carbon Black." G. R. Hopkins and H. Backus. Chapter (Preprint) taken from "Minerals Yearbook—1939, Review of 1938." Published by the United States Bureau of Mines, Washington, D. C. For sale by the Superintendent of Documents, Washington, 5¢. 8 pages. According to this pamphlet, the year 1938 was not a particularly prosperous one for the carbon black industry; compared with 1937 domestic sales and exports dropped 20 and 9%, respectively; while the average f.o.b. plant price fell from 3.41¢ per pound in 1937 to 2.41¢ in 1938. Stocks at producing plants rose from 100,497,000 pounds the first of 1938 to 166,159,000 pounds on December 31, 1938. Included in the pamphlet are details on: production by states, districts, and months; methods and yields; number and capacity of plants; producers; total deliveries; domestic consumption; exports and imports; stocks; prices and values.

"Dominion Cone Worm Gear Units." Dominion Engineering Co., Ltd., Box 220, Montreal, P. Q., Canada. 34 pages. This illustrated pamphlet describes in detail the Cone worm gear, a double enveloping worm gearing of the hourglass or globoidal type. The discussion covers the theory, design, production, and mounting of these gear units. Engineering data in the form of tables are presented to enable the selection of the proper unit for a specific application.

"Whitney Silent Chains and Sprockets." The Whitney Chain & Mfg. Co., Hartford, Conn. 64 pages. This catalog presents information for the selection of the firm's silent chain drive and includes dimensions, horsepower ratings, sprocket data, and other pertinent engineering data relating to these drives, and pictures of typical installations.

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Market Reviews

CRUDE RUBBER

Commodity Exchange

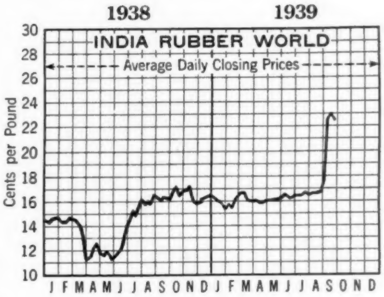
TABULATED WEEK-END CLOSING PRICES

Futures	July 29	Aug. 26	Sept. 2	Sept. 9	Sept. 16	Sept. 23
Sept.	16.47	16.75	18.15	22.00	21.80	21.50
Oct.	.....	.....	18.00	21.00	21.00	20.80
Dec.	16.54	16.48	17.90	20.95	20.60	20.20
Mar.	16.57	16.41	17.88	20.13	19.30	19.18
July	.....	16.37	17.85	20.16	19.00	18.92
Aug.	.....	.....	17.85	20.16	19.00	18.92
Volume per week (tons)...	4,600	7,860	15,210	17,980	14,130	11,310

THE Commodity Exchange table published here shows prices of representative future contracts of the New York market for the last two months.

The rubber market which had held generally steady for a year sharply advanced during the past month following the outbreak of the war in Europe. The September, or spot month, unrestricted in price advance, reflected the true demand for this essential war commodity. Closing at 16.46¢ per pound on August 31, the September price jumped to 18.75¢ on September 1 and then to a high of 23.50¢ on September 5. Thereafter the price was easier, fluctuating between rather wide limits, and closed at the lower level of 21.40¢ on September 21. The closing price on September 26 was 20.05¢ per pound. The more distant months followed this upward movement, but they were retarded by the 200-point-per-day limit set by the exchange. After the period of adjustment, however, there was a wide spread between prices of nearby and distant months with the nearby months quoted higher. This reflected the greater demand for nearby delivery.

Trading during September was only moderate in volume. In the earlier part of the month trading was restricted with little rubber offered for sale. Following news that the domestic supply of rubber was not seriously threatened by hostilities abroad and that large quantities were now in shipment to this country, buying interest became somewhat quieter. As a result of reassurances regarding the shipment of rubber, war risk insurance rates were reduced on September 25 from 4 to 3% on shipments on belligerent vessels.



New York Outside Market—Spot Ribbed Smoked Sheets

New York Quotations

New York outside market rubber quotations in cents per pound

	Sept. 26, 1938	Aug. 28, 1939	Sept. 28, 1939
Plantations			
Rubber latex..*gal.*	57/58	64/65	76/77
Paras			
Upriver fine	15⅝	14½	18½
Upriver fine	*18¼	*17⅜	*21½
Upriver coarse...	10	10¼	13
Upriver coarse...	*15¼	*15½	*20
Islands fine......	15	14¼	18
Islands fine......	*17½	*17	*21
Acre, Bolivian fine	15⅞	14¾	19
Acre, Bolivian fine	*18½	*17½	*22
Beni, Bolivian fine	16½	15¼	20
Madeira fine	15⅝	14½	18¾
Caucho			
Upper ball.......	10	10¼	13
Upper ball.......	*15¼	*15½	*20
Lower ball.......	9	9¾	12
Pontianak			
Pressed block ...	12/20	9/15	11/18
Guayule			
Duro, washed and dried	13¼	13	13
Ampar	13¾	13¼	13¼
Africans			
Rio Nuñez	17	16	18
Black Kassai ...	16½	16	18
Prime Niger flake.	25	20	21
Gutta Percha			
Gutta Siak	12	9½	14
Gutta Soh	17½	15	18
Red Macassar..	1.20/1.90	1.20	1.30
Balata			
Block, Ciudad Bolivar	..	..	33
Manaos block ...	27½	30	33
Surinam sheets...	39	40	43
Amber	40	43	45

*Washed and dried crepe. Shipments from Brazil.

It was officially announced from London that for the purpose of buying rubber for shipment to New York and other ports in the United States pursuant to the Anglo-American barter Agreement, the Ministry of Supply is opening a market office in the Rubber Exchange Building. John Riddell has been appointed chief buyer by the Ministry, which proposes to buy in the United Kingdom from dealers domiciled there, also from broker members of the Rubber Trade Association acting in behalf of producers, producer agents, shippers, and dealers. The date of the opening of the office, together with full particulars of the purchase procedure, are to be announced later.

The International Rubber Regulation Committee, according to a statement on September 9, revised the quota for the fourth quarter of 1939 to 70% of basic quotas. The decision adds approximately 36,000 tons to the potential rubber supply for the last quarter. With the new quota, 93,837 tons of rubber per month will be available from all agreement countries. An added 3,000 tons monthly may be expected from non-agreement territories. World absorption during the first seven months of this year averaged 87,865 tons monthly. Elsewhere in this issue a survey is presented concerning the domestic supply of crude, reclaimed, and synthetic rubber and its relation to the current international situation.

New York Outside Market

The outside market was fairly active during the past month, with buying spurred by European events. Shipment offerings from the British possessions of the Far East were generally scarce; while a fair amount was offered from Netherland India. Domestic factories and Russia were steady buyers during the month; while Italy showed an interest in spot rubber toward the latter part of September. In company with the futures market the outside marked advanced sharply: the price of No. 1 ribbed smoked sheets, after closing at 16⅞¢ per pound on August 31, rose to a high of 25¢ on September 5 and thereafter was easier, closing at 22½¢ per pound on September 21. The closing price on September 28 was 21¢ per pound.

The week-end closing prices on No. 1 ribbed smoked sheets follow: September 2, 19½¢; September 9, 22½¢; September 16, 22½¢; and September 23, 22½¢.

New York Outside Market — Spot Closing Prices — Plantation Grades — Cents per Pound

	August, 1939				September, 1939						
	28	29	30	31	1	2	4*	5	6	7	8
No. 1 Ribbed Smoked Sheet.	16 13/16	16¾	16 13/16	16⅞	19½	19½	..	25	23	20	21½
No. 1 Thin Latex Crepe.....	18½	18 7/16	18½	18 9/16	21	21	..	26	24	21	22½
No. 2 Thick Latex Crepe....	19 5/16	19¼	19 5/16	19⅜	21	21	..	26	24	21	22½
No. 1 Brown Crepe.........	16 7/16	16⅜	16 7/16	16½	19	19	..	24¼	22¼	19¼	20¾
No. 2 Brown Crepe.........	16 5/16	16¼	16 5/16	16⅜	18¾	18¾	..	24	22	19	20½
No. 2 Amber...............	16 7/16	16⅜	16 7/16	16½	19	19	..	24¼	22¼	19¼	20¾
No. 3 Amber...............	16 5/16	16¼	16 5/16	16⅜	18¾	18¾	..	24	22	19	20½
Rolled Brown..............	15 5/16	15¼	15 5/16	15⅜	17¾	17¾	..	23½	21½	18½	20

	September, 1939											
	9	11	12	13	14	15	16	18	19	20	21	22	23
No. 1 Ribbed Smoked Sheet.	22½	24	23½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½
No. 1 Thin Latex Crepe.....	23½	25	24½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½
No. 2 Thick Latex Crepe....	23½	25	24½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½
No. 1 Brown Crepe.........	21¾	23¼	22¾	21¾	21¾	21¾	21¾	21¾	21¾	21¾	21¾	21¾	21¾
No. 2 Brown Crepe.........	21½	23	22½	21½	21½	21½	21½	21½	21½	21½	21½	21½	21½
No. 2 Amber...............	21¾	23¼	22¾	21¾	21¾	21¾	21¾	21¾	21¾	21¾	21¾	21¾	21¾
No. 3 Amber...............	21½	23	22½	21½	21½	21½	21½	21½	21½	21½	21½	21½	21½
Rolled Brown..............	21	22½	22	21	21	21	21	21	21	21	21	21	21

*Holiday.

IMPORTS, CONSUMPTION, AND STOCKS

United States and World Statistics of Rubber Imports, Exports, Consumption, and Stocks

Twelve Months	U. S. Imports* Tons	U. S. Consumption¶ Tons	U. S. Stocks Mfgrs., Importers, Dealers, Etc.† Tons	U. S. Stocks Afloat† Tons	U. K.—Public Warehouses, London Liverpool†‡ Tons	Singapore and Penang Dealers and Port Stocks†‡ Tons	World Production (Net Exports)‡ Tons	World Consumption Estimated‡ Tons	World Stocks†‡§ Tons
1937	584,851	543,600	262,204	63,099	57,785	44,792	1,139,800	1,104,891	646,252
1938	400,178	437,031	231,500	45,105	86,853	27,084	894,944	941,482	596,498
1938									
Jan.	42,135	31,265	276,497	57,356	62,108	48,494	80,339	70,141	639,445
Feb.	43,930	25,357	292,067	47,459	71,516	46,241	81,179	63,951	651,784
Mar.	35,967	32,389	301,762	41,882	76,617	50,797	82,024	80,467	673,180
Apr.	30,807	29,730	303,901	39,071	82,754	40,614	87,234	71,613	671,163
May	27,410	30,753	300,907	32,859	87,215	40,598	65,151	78,418	655,116
June	26,011	32,540	294,796	32,079	92,312	44,729	71,195	72,310	670,362
July	22,918	34,219	282,785	40,400	95,252	45,529	80,209	74,305	668,803
Aug.	31,099	40,552	273,841	47,772	99,614	41,002	75,213	75,780	651,139
Sept.	37,374	40,183	268,094	48,927	98,140	35,386	71,211	80,143	637,943
Oct.	34,496	42,850	259,074	51,062	93,272	34,901	75,869	88,617	623,950
Nov.	31,054	49,050	242,592	51,114	90,073	31,255	67,370	94,672	592,580
Dec.	36,977	48,143	231,500	45,105	86,853	27,084	57,950	91,065	596,498
1939									
Jan.	39,082	46,234	223,879	48,210	80,643	30,975	87,497	89,020	585,812
Feb.	36,490	42,365	217,534	55,814	75,517	28,559	77,646	83,895	569,161
Mar.	38,989	50,165	205,936	55,981	72,235	23,255	76,975	95,061	545,840
Apr.	29,601	44,166	190,896	57,918	68,931	22,434	73,865	86,632	519,032
May	47,535	44,377	193,602	54,046	66,020	20,849	70,740	89,242	512,228
June	35,947	47,259	181,794	51,274	63,878	19,563	64,410	91,061	491,625
July	36,739	43,880	174,240	52,990	57,234	27,042	84,371	85,927	......
Aug.	38,045	50,481	161,358	66,717	......	......	......	......	......

*Including liquid latex. †Stocks on hand the last of the month or year. ‡Statistical Bulletin of the International Rubber Regulation Committee. §Stocks at U. S. A., U. K., Singapore and Penang, Para, Manaos, regulated areas, and afloat. ¶Corrected to 100% from estimate of reported coverage.
a Include stocks from Japan.

CRUDE RUBBER consumption by United States manufacturers during August is estimated at 50,481 long tons, against 43,880 long tons during July, a 16.8% increase, and 23.7% over the 40,552 (revised) long tons consumed in August, 1938, according to the R.M.A.

Gross imports of crude rubber for August are reported to be 38,045 long tons, 3.6% over the July figure of 36,739 long tons and 22.3% over the 31,099 long tons imported in August, 1938.

Total domestic stocks of crude rubber on hand August 31 are estimated at 161,358 long tons, compared with July 31 stocks of 174,240 long tons and 273,841 (revised) long tons on hand August 31, 1938.

Crude rubber afloat to U. S. ports as of August 31 is estimated at 66,717 long tons, against 52,990 long tons afloat on July 31 and 47,772 long tons afloat on August 31, 1938.

United States Reclaimed Rubber Statistics—Long Tons

Year	Production	Consumption†	Consumption % to Crude	U. S. Stocks*	Exports
1937	185,033	162,000	29.8	28,800	13,233
1938	122,403	120,800	27.6	23,000	7,403
1939					
Jan.	14,826	13,743	29.7	23,334	748
Feb.	14,102	13,347	31.5	23,461	630
Mar.	15,647	16,197	32.3	22,155	756
Apr.	14,527	13,391	30.3	22.628	748
May	14,769	13,517	30.5	22,771	1,008
June	15,871	14,870	31.5	23,058	759
July	12,588	13,542	30.9	21,339	1,036
Aug.	17,214	16,846	33.4	20,645	...

*Stocks on hand the last of the month or year. †Corrected to 100% from estimate of reported coverage.
Compiled by The Rubber Manufacturers Association, Inc.

United States Latex Imports

Year	Pounds (d.r.c.)	Value
1937	51,934,040	$10,213,670
1938	26,606,048	4,147,318
1939		
Jan.	3.589.452	599.927
Feb.	3.844.996	657.565
Mar.	4,491,951	731,302
Apr.	2.279.171	360.739
May	6.240.019	1,067.682
June	4,111,994	694.863
July	6,572,567	1,064,927

Data from Leather and Rubber Division.

Popular Priced Rubber Flooring

A popular priced rubber flooring product of top quality has been announced by The Goodyear Tire & Rubber Co., which can be applied in the same manner as linoleum. Identified as medium-gage Wingfoot Flooring, this new, lowest price rubber floor covering is being manufactured in rolls of 36-inch width, 40 to 45 yards in length, gage 0.095-inch, in seven colors: red and white, plain black, black and white, two-tone medium gray, green and white, brown and white, two-tone light tan. Medium-gage Wingfoot flooring is said to have all the advantages of beauty, cleanliness, comfort, style, and durability. Dirt does not penetrate the surface, and a damp mop is usually adequate for cleaning.

RUBBER SCRAP

THE demand for scrap rubber during September was active, but the actual volume of sales was retarded by small dealers withholding their scrap.

The market is firm with many grades of scrap showing advances over last month's prices; other grades are steady and unchanged.

Consumers' Buying Prices

(Carload Lots for September 25, 1939)

		Prices
Boots and Shoes		
Boots and shoes, black	*lb.*	$0.01 /$0.01⅛
Colored	*lb.*	.00¾/ .00⅞
Untrimmed arctics	*lb.*	.00¾/ .00⅞
Inner Tubes		
No. 1, floating	*lb.*	.09½/ .10
No. 2, compound	*lb.*	.05 / .05⅛
Red	*lb.*	.04¾/ .05
Mixed tubes	*lb.*	.04½/ .04¾
Tires (Akron District)		
Pneumatic Standard		
Mixed auto tires with beads	*ton*	15.00 /16.50
Beadless	*ton*	19.50 /20.00
Auto tire carcass	*ton*	24.00 /26.00
Black auto peelings	*ton*	26.00 /27.00
Solid		
Clean mixed truck	*ton*	30.00 /32.00
Light gravity	*ton*	40.00 /41.00
Mechanicals		
Mixed black scrap	*ton*	20.00 /22.00
Hose, air brake	*ton*	20.00 /22.50
Garden, rubber covered	*ton*	11.50 /13.00
Steam and water, soft	*ton*	11.50 /13.00
No. 1 red	*lb.*	.03 / .03¼
No. 2 red	*lb.*	.02¼/ .02½
White druggists' sundries	*lb.*	.03¾/ .04
Mixed mechanicals	*lb.*	.02¼/ .02½
White mechanicals	*lb.*	.03⅝/ .03¾
Hard Rubber		
No. 1 hard rubber	*lb.*	.11 / .11½

RECLAIMED RUBBER

ACCORDING to R. M. A. figures, August reclaimed rubber consumption is estimated at 16,846 long tons, 24.4% above that of July; production, 17,214 long tons; stocks on hand August 31, 20,645 long tons. The market during September was active with interest in reclaim accelerated as a result of increasing crude rubber prices. Actual consumption of reclaim during the past month is expected to be only slightly greater than that of August.

The market is firm with prices of tire, shoe, and mechanical reclaim quoted at last month's levels; and those of tube and white reclaims showing an advance in price.

New York Quotations

September 25, 1939

	Sp. Grav.	¢ per lb.
Auto Tire		
Black Select	1.16-1.18	6 / 6¼
Acid	1.18-1.22	7 / 7¼
Shoe		
Standard	1.56-1.60	6½/ 6¾
Tubes		
Red Tube	1.15-1.30	9 / 9¼
Compound	1.10-1.20	9 /10
Miscellaneous		
Mechanical Blends	1.25-1.50	4½/ 5
White	1.35-1.50	12 /14½

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

COMPOUNDING INGREDIENTS

THE movement of compounding ingredients into consuming channels continued at a high level during September, with demand conditions slightly better than in August. Present indications point toward continued activity for the balance of the year.

No general upward movement in prices has yet been evident, but for the most part a firmness exists with no tendency toward recession. Increasing prices of raw materials may bring about upward revisions in the prices of some of these ingredients, but it is quite generally felt by suppliers that the necessary requirements can be taken care of without much disruption of the market.

CARBON BLACK. Consumption of carbon black continued at a high level during September, and indications point toward a sustained demand over the next few months. Despite heavy consumption the price remains unchanged.

FACTICE OR RUBBER SUBSTITUTE. The demand remained active with prices firm. Several grades advanced in price; while others were unchanged. Further advances may take place shortly.

LITHARGE. There was a heavy demand for this material during September. Following a rise in pig lead quotations prices of litharge were advanced ¼¢ per pound on September 5 and ¼¢ per pound on September 6. The new quotations are: 20 tons or more, .0635¢ to .0710¢ per pound, depending upon delivery point; five tons or more, 7¼¢ to 8¢ per pound; smaller lots, 7¾¢ to 8½¢ per pound.

LITHOPONE. The market was relatively quiet during early September, but became more active at mid-month under the influence of increased demand. Prices are firm and unchanged.

RUBBER CHEMICALS. The demand for accelerators and antioxidants during September was somewhat higher than in the preceding month. Prices remain substantially unchanged. In regard to rubber toners, no price advances are anticipated before the first of next year with the possible exception of one or two products which are based on an imported chemical now becoming scarce.

RUBBER SOLVENTS. With tire manufacturers active, these solvents were in good demand during September. Prices are firm and unchanged.

TITANIUM PIGMENTS. Consumption of these pigments by the rubber industry was considered good and showed some improvement over August. The market was steady, and prices remained unchanged. Producers have decided to continue present price levels throughout the balance of this year unless unforeseen circumstances arise.

ZINC OXIDE. The demand last month continued to hold at a high level. Prices are firm and unchanged.

New York Quotations*

September 25, 1939

Abrasives			
Pumicestone, powdered	lb.	$0.03	/$0.035
Rottenstone, domestic	lb.	.03	/ .035
Silica, 15	ton	38.00	
Accelerators, Inorganic			
Lime, hydrated, l.c.l., New York	ton	20.00	
Litharge (commercial)	lb.	.0675	/ .0725
Accelerators, Organic			
A-1	lb.	.24	/ .30
A-10	lb.	.31	/ .35
A-11	lb.	.52	/ .65
A-19	lb	.52	/ .65
A-32	lb.	.70	/ .80
A-77	lb.	.42	/ .55
A-100	lb.	.42	/ .55
Accelerator 49	lb.	.40	/ .42
737	lb.	.42	/ .43
737-50	lb.	.25	/ .26
808	lb.	.70	/ .72
833	lb.	1.15	
Acrin	lb.	.60	
Aldehyde ammonia	lb.	.70	
Altax	lb.	.55	/ .70
B-J-F	lb.	.50	/ .55
Beutene	lb.	.70	/ .75
Butyl Zimate	lb.	2.50	
C-P-B	lb.	2.00	
Captax	lb.	.50	/ .60
Crylene	lb.	.40	/ .47
Paste	lb.	.30	/ .36
D-B-A	lb.	2.00	
Delac A	lb.	.40	/ .50
O	lb.	.40	/ .50
P	lb.	.40	/ .50
Di-Esterex	lb.	.60	/ .70
N	lb.	.60	/ .70
DOTG (Di-ortho-tolylguanidine)	lb.	.44	/ .46
DPG (Diphenylguanidine)	lb.	.35	/ .36
El-Sixty	lb.	.50	/ .65
Ethylideneaniline	lb.	$0.42	/$0.43
Ethyl Zimate	lb.	2.50	
Formaldehyde P.A.C.	lb.	.0625	
Formaldehydeaniline	lb.	.31	
Formaldehyde-para-toluidine	lb.	.52	/ .54
Guantal	lb.	.40	/ .50
Hepteen	lb.	.35	/ .40
Base	lb.	1.35	/ 1.50
Hexamethylenetetramine U.S.P.	lb.	.39	
Technical	lb.	.33	
Lead oleate, No. 999	lb.	.135	
Witco	lb.	.15	
Monex	lb.	2.35	
Novex	lb.		
O. N. V.	lb.	1.00	/ 1.10
O-X-A-F	lb.	.50	/ .55
Ovac	lb.	.50	/ .55
Para-nitroso-dimethylaniline	lb.	.85	
Pentex	lb.	1.00	/ 1.10
Flour	lb.	.15	/ .16
Pip-Pip	lb.	2.50	
Pipsolene	lb.	1.55	/ 1.85
R-2	lb.	1.40	/ 1.80
R-23	lb.	.40	
R & H 50-D	lb.	.42	/ .43
Rotax	lb.	.60	/ .65
Safex	lb.	1.20	/ 1.30
Santocure	lb.	.80	/ 1.00
Super-sulphur No. 1	lb.	.50	
2	lb.	.18	/ .25
Tetrone A	lb.	2.70	
Thiocarbanilide	lb.	.24	
Thionex	lb.	2.35	
Trimene	lb.	.55	/ .65
Base	lb.	1.05	/ 1.20
Triphenylguanidine (TPG)	lb.	.45	
Tuads	lb.	2.35	
Ureka	lb.	.60	/ .75
Blend B	lb.	.60	/ .75
C	lb.	.56	/ .65
Vulcanex	lb.	.42	/ .43
Vulcanol	lb.	.85	
Z-B-X	lb.	2.50	
Zenite	lb.	.46	/ .48
A	lb.	.53	/ .55
B	lb.	.46	/ .48
Zimate	lb.	2.35	
Activator			
Aero Ac 50	lb.	.46	/ .52
Barak	lb.	.50	
Age Resisters			
AgeRite Alba	lb.	$1.50	/$2.00
Exel	lb.	1.00	/ 1.40
Gel	lb.	.57	/ .75
Hipar	lb.	.65	/ .92
Powder	lb.	.52	/ .65
Resin	lb.	.52	/ .65
D	lb.	.52	/ .65
White	lb.	1.25	/ 1.65
Akroflex C	lb.	.56	/ .58
Albasan	lb.	.70	/ .75
Aminox	lb.	.52	/ .61
Antox	lb.	.56	
B-L-E	lb.	.52	/ .61
Powder	lb.	.65	/ .74
B-X-A	lb.	.52	/ .61
Copper Inhibitor X-872-A	lb.	1.15	
Flectol B.	lb.	.52	/ .65
H	lb.	.52	/ .65
White	lb.	.90	/ 1.15
M-U-F	lb.	1.50	
Neozone (standard)	lb.	.63	
A	lb.	.52	/ .54
B	lb.	.63	
C	lb.	.52	/ .54
D	lb.	.52	/ .54
E	lb.	.63	
Oxynone	lb.	.64	/ .80
Parazone	lb.	.68	
Permalux	lb.	1.20	
Santoflex B	lb.	.52	/ .65
Solux	lb.	1.30	
Thermoflex A	lb.	.65	/ .67
V-G-B	lb.	.52	/ .61
Alkalies			
Caustic soda, flake, Columbia (400 lb. drums)	100 lbs.	2.70	/ 3.55
liquid, 50%	100 lbs.	1.95	
solid (700 lb. drums)	100 lbs.	2.30	/ 3.15
Antiscorch Materials			
A-F-B	lb.	.35	/ .40
Antiscorch T	lb.	.90	
E-S-E-N	lb.	.35	/ .40
R-17 Resin (drums)	lb.	.10	
RM	lb.	1.25	
Retarder W	lb.	.36	
U.T.B.	lb.	.35	/ .40
Antisun Materials			
Heliozone	lb.	.21	
Sunproof	lb.	.20	/ .25
Colors			
BLACK			
Du Pont powder	lb.	.42	/ .44
Lampblack (commercial)	lb.	.15	
BLUE			
Brilliant	lb.		
Du Pont dispersed	lb.	.83	/ 3.60
Powders	lb.	2.25	/ 3.75
Prussian	lb.	.0375	
Toners	lb.	.08	/ 3.85
BROWN			
Mapico	lb.	.11	
GREEN			
Brilliant	lb.		
Chrome, light	lb.		
medium	lb.	.22	
oxide (freight allowed)	lb.		
Dark	lb.		
Du Pont dispersed	lb.	.98	/ 1.75
Powders	lb.	1.00	/ 2.00
Guignet's, Easton, Pa., bbls.	lb.	.70	
Light	lb.		
Toners	lb.	.85	/ 3.75
ORANGE			
Du Pont dispersed	lb.	.88	/ .90
Powders	lb.	.80	/ 2.50
Lake	lb.		
Toners	lb.	.40	/ 1.60
ORCHID			
Toners	lb.	1.50	/ 2.00
PINK			
Toners	lb.	1.50	/ 2.00
PURPLE			
Permanent	lb.		
Toners	lb.	.60	/ 2.10
RED			
Antimony			
Crimson, 15/17%	lb.	.45	
R. M. P. No. 3	lb.	.48	
Sulphur free	lb.	.50	
R.M.P.	lb.	.52	
Golden 15/17%	lb.	.28	
7-A	lb.	.37	
Z-2	lb.	.23	
Aristi	lb.	1.75	
Cadmium, light (400 lb. bbls.)	lb.	.70	/ .75
Chinese	lb.		
Crimson	lb.		
Du Pont dispersed	lb.	.93	/ 2.05
Powders	lb.	.52	/ 1.05
Mapico	lb.	.0925	
Medium	lb.		
Rub-Er-Red, Easton, Pa., bbls.	lb.	.0925	
Scarlet	lb.		
Toners	lb.	.08	/ 2.00

*Prices not recorded will be supplied on application.

WHITE
Lithopone (bags) lb. $0.0375/$0.04
Albalith Black Label-11 lb. .0375/ .04
Astrolith lb. .0375/ .04
Azolith lb. .0375/ .04
Cryptone-BA-19 lb. .0525/ .055
BT lb. .0525/ .055
CB lb. .0525/ .055
ZS No. 20 lb. .075 / .0775
86 lb. .07⅞/ .08⅛
230 lb. .07⅞/ .08⅛
Sunolith lb. .0375/ .04
Ray-Bar lb. .0525/ .0625
Ray-Cal lb. .0525/ .0625
Rayox lb. .13 / .16
Titanolith (5-ton lots) lb. .0525/ .055
Titanox-A (50-lb. bags) lb. .13 / .1375
B (50-lb. bags) lb. .0525/ .055
30 (50-lb. bags) lb. .0525/ .055
C (50-lb. bags) lb. .0525/ .055
M (50-lb. bags) lb. .0525/ .055
Ti-Tone lb.
Zinc Oxide
Azo ZZZ-11 lb. .0625/ .065
44 lb. .0625/ .065
55 lb. .0625/ .065
66 lb. .0625/ .065
French Process, Florence
White Seal-7 (bbls.) lb. .085 / .0875
Green Seal-8 lb. .08 / .0825
Red Seal-9 lb. .075 / .0775
Kadox, Black Label-15 lb. .065 / .0675
No. 25 lb. .075 / .0775
Red Label-17 lb. .065 / .0675
Horse Head Special 3 lb. .0625/ .065
XX Red-4 lb. .0625/ .065
23 lb. .0625/ .065
72 lb. .0625/ .065
78 lb. .0625/ .065
80 lb. .0625/ .065
103 lb. .0625/ .065
110 lb. .0625/ .065
St. Joe (lead free)
Black Label lb. .0625/ .065
Green Label lb. .0625/ .065
Red Label lb. .0625/ .065
U.S.P. lb. .095 / .0975
White Jack lb. .075 / .0775
Zopaque lb. .13 / .1475

YELLOW
Cadmolith (cadmium yellow), 400 lb. bbls. lb. .45 / .50
Du Pont dispersed lb. 1.25 / 1.75
Powders lb. 1.55 / 1.37
Lemon lb.
Mapico lb. .0675
Toners lb. 2.50

Dispersing Agents
Darvan lb. .30 / .47
Nevoll (drums) lb. .0215
Santomerse S lb. .11 / .25

Fillers, Inert
Asbestine, c.l., f.o.b., mills ton 15.00
Barytes ton 30.00 /36.00
f.o.b., St. Louis (50 lb. paper bags) ton 22.85
off color, domestic ton 20.00 /25.00
white, imported ton 29.00 /32.00
Blanc fixe, dry, precip. lb. .03 / .035
Calcene ton 37.50 /43.00
Infusorial earth lb. .02 / .03
Kalite No. 1 ton 24.00 /50.00
3 ton 34.00 /60.00
Magnesia, calcined, heavy lb. .04
Carbonate, l.c.l. lb. .07 / .095
Pyrax A ton 6.50 /20.00
Whiting
Columbia Filler ton 9.00 /14.00
Guilders 100 lbs.
Hakuenka lb.
Paris white, English cliff-stone 100 lbs.
Southwark Brand, Commercial 100 lbs.
All other grades 100 lbs.
Suprex, white extra light ton 45.00 /60.00
heavy ton 45.00 / 60.00
Witco, c.l. ton 6.00

Finishes
Rubber lacquer, clear gal.
colored gal.
Starch, corn, pwd. 100 lbs.
potato lb.
Talc ton 25.00 /45.00

Flock
Cotton flock, dark lb. .105 / .13
dyed lb. .45 / .85
white lb. .12 / .18
Rayon flock, colored lb. 1.10 / 1.50
white lb. .90

Latex Compounding Ingredients
Accelerator 85 lb. .35
89 lb. 1.40
122 lb. 1.55
552 lb. 2.50
Aerosol OT Aqueous 10% lb. .15
Antox, dispersed lb. .42
Aquarex A lb. .35
D lb. .75
F lb. .85
WA Paste lb. .25
Areskap No. 50 lb. .18 / .24
100, dry lb. .39 / .51
Aresket No. 240 lb. $0.16 /$0.22
300, dry lb. .42 / .50
Aresklene No. 375 lb. .35 / .50
400, dry lb. .51 / .65
Black No. 25, dispersed lb. .22 / .40
Catalpo ton
Collocarb lb. .055 / .07
Color Pastes, dispersed lb. .35 / 1.90
Dispersex No. 15 lb. .11 / .12
No. 20 lb. .08 / .10
Emo, brown lb. .15
white lb. .15
Factice Compound, dispersed lb. .36
Heliozone, dispersed lb. .25
Igepon A lb.
MICRONEX, Colloidal lb. .055 / .07
Nekal BX (dry) lb.
Palmol lb. .10
Pipsol X lb. 3.05 / 3.55
R-2 Crystals lb. 2.50 / 2.75
R-23 lb. .40
R-N-2 lb. 1.40 / 1.80
Crystals lb. 2.00 / 2.25
S.1 (400 lb. drums) lb. .65
Santomerse D lb. .41 / .65
S lb. .11 / .25
No. 1 lb. .18 / .35
No. 2 lb. .18 / .35
No. 3 lb. .40 / .65
No. 3P lb. .29 / .45
Santovar A lb. 1.15 / 1.40
Stablex A lb. .90 / 1.10
B lb. .65 / .90
C lb. .40 / .50
Sulphur, dispersed lb. .10 / .15
No. 2 lb. .075 / .15
T.1. (400 lb. drums) lb. .40
Tepidone lb. 1.45
Vulcan Colors lb.
Zinc oxide, dispersed lb. .12 / .15

Mineral Rubber
Black Diamond ton 25.00
Hydrocarbon, hard ton 22.00 /42.00
Parmr ton 22.00 /24.00
Pioneer ton
285°-300° ton 22.00 /42.00

Mold Lubricants
Mold Paste lb. .12 / .18
Sericite ton 65.00 /75.00
Soapbark lb.
Soapstone ton 25.00 /35.00

Oil Resistant
AXF lb. .40 / .50

Reenforcers
Carbon Black
Aerfloted Arrow Specification Black lb. .0275/ .0625
Arrow Compact Granulized Carbon Black lb. .0275/ .0625
"Certified" Heavy Compressed. Cabot lb.
Spheron lb.
Carbitum ton 58.00/ 63.00
Continental Dustless, c.l. lb. .0275
Compressed, c.l. lb. .0275
Uncompressed, c.l. lb. .0275
Disperso, c.l. lb. .0275/ .0375
Dixie, c.l., f.o.b. New Orleans, La., Galveston or Houston, Tex. lb. .0275
c.l., delivered New York lb. .0375
local stock, bags, delivered lb. .0625
Dixiedensed, c.l., f.o.b., New Orleans, La., Galveston or Houston, Tex. lb. .0275
c.l., delivered New York lb. .0375
local stock, bags, delivered lb. .0625
Dixiedensed, 66, c.l., f.o.b., New Orleans, La., Galveston or Houston, Tex. lb. .0275
c.l., delivered New York lb. .0375
local stock, bags, delivered lb. .0625
Excello, c.l., f.o.b., Gulf ports 100 lbs. 2.75 / 4.75
delivered New York 100 lbs. 3.75 / 5.75
l.c.l., delivered New York 100 lbs. 6.25 / 7.00
Fumonex, c.l., f.o.b. works lb. .03
ex-warehouse lb. .05
Gastex lb. .03 / .07
Kosmobile, c.l., f.o.b. New Orleans, La., Galveston or Houston, Tex. lb. .0275
c.l., delivered New York lb. .0375
local stock, bags, delivered lb. .0625
Kosmobile 66, c.l., f.o.b. New Orleans, La., Galveston or Houston, Tex. lb. .0275
c.l., delivered New York lb. .0375
local stock, bags, delivered lb. .0625
Kosmos c.l., f.o.b New Orleans, La., Galveston or Houston, Tex. lb. .0275
c.l., delivered New York lb. .0375
local stock, bags, delivered lb. .0625
MICRONEX Beads, c.l., f.o.b. Gulf ports lb. $0.0275
c.l., delivered, New York lb. .0375
local stock, bags, delivered lb. .0625
Mark II, c.l., f.o.b. Gulf ports lb. .0275
c.l., delivered, New York lb. .0375
local stock, bags, delivered lb. .0625
Standard, c.l., f.o.b. Gulf ports lb. .0275
c.l., delivered, New York lb. .0375
local stock, bags, delivered lb. .0625
W-5, c.l., f.o.b., Gulf ports lb. .0275
c.l., delivered, New York lb. .0375
local stock, bags, delivered lb. .0625
W-6, c.l., f.o.b., Gulf ports lb. .0275
c.l., delivered, New York lb. .0375
local stock, bags, delivered lb. .0625
Paradene No. 2 (drums) lb. .04
Pelletex lb. .03 /$0.07
Supreme, c.l., f.o.b. Gulf ports 100 lbs. 2.75 / 4.75
delivered New York 100 lbs. 3.75 / 5.75
l.c.l., delivered New York 100 lbs. 6.25 / 7.00
"WYEX BLACK" lb. .0275/ .0625
Clays
Aerfloted Paragon (50 lb. bags) ton 9.50 /22.00
Suprex (50 lb. bags) ton 9.50 /22.00
Barden lb.
Chicora lb.
China ton 17.50 /20.00
Crown, f.o.b. (plant) ton 9.50
Dixie ton 11.00 /26.00
Junior ton 9.50 /24.00
Hi-White, f.o.b. Huber Ga. ton 9.50
McNamee ton 9.50 /22.00
Par ton 9.50 /22.00
Witco, f.o.b. works ton 9.50
P-33 lb. .0475/ .0775
Thermax lb. .0175/ .05
Velvetex lb. .022 / .035

Reodorants
Amora A lb.
B lb.
C lb.
D lb.
Curodex 19 lb. 2.75
188 lb. 3.50
198 lb. 4.50
Rodo No. 0 lb. 3.50 / 4.00
10 lb. 4.50 / 5.00

Rubber Substitutes
Black lb. .08 / .12
Brown lb. .08 / .105
White lb. .085 / .12
Factice
Amberex lb. .17
Brown lb. .07 / .095
Fac-Cel B lb. .12
C lb. .12
Neophax A lb. .0925
B lb. .0925
White lb. .08 / .115

Softeners
Bondogen lb. .98 / 1.50
Burgundy pitch lb. .06
Cycline oil gal. .14 / .20
Nuba resinous pitch (drums)
Grades No. 1 and No. 2 lb. .0265
Nubalene Resin lb. .025
Palm oil (Witco), c.l. lb. .0575
Pine tar gal.
Plastogen lb. .0775/ .12
R-19 Resin (drums) lb. .10
R-21 Resin (drums) lb. .10
Reogen lb. .115 / .26
Rosin oil, compounded gal. .40
RPA No. 1 lb. .65
2 lb. .65
3 lb. .46
Rubtack lb. .10
Tackol lb. .08 / .18
Tonox lb. .52 / .61
Tonox D lb. .75 / .85
Witco No. 20 gal. .20
X-1 Resinous oil (tank car) lb. .019

Solvents
Beta-Trichlorethane gal.
Carbon bisulphide lb.
tetrachloride lb.
Industrial 90% benzol (tank car) gal. .16
Skellysolve gal.

(Continued on page 116)

COTTON AND FABRICS

New York Quotations

September 25, 1939

Drills	
38-inch 2.00-yard............yd.	$0.13
40-inch 3.47-yard................	.07¾
50-inch 1.52-yard................	.18¼
52-inch 1.85-yard................	.15⅜
52-inch 1.90-yard................	.14¼
52-inch 2.20-yard................	.13¼
52-inch 2.[illegible]0-yard................	.11¾
59-inch 1.85-yard................	.14½
Ducks	
38-inch 2.00-yard D.F........yd.	.13
40-inch 1.45-yard S. F...........	.17⅝
51½-inch 1.35-yard D. F.........	.19¼
72-inch 1.05-yard D. F..........	.25½/.26¾
72-inch 17.21-ounce	.30
Mechanicals	
Hose and belting...........lb.	.30
Tennis	
52-inch 1.35-yard ....yd.	.20⅜
Hollands	
Gold Seal and Eagle	
20-inch No. 72..............yd.	.10
30-inch No. 72................	.18
40-inch No. 72................	.20
Red Seal and Cardinal	
20-inch ....yd.	.08½
30-inch	.15¾
40-inch	.17
50-inch	.26
Osnaburgs	
40-inch 2.34-yard ....yd.	.10¾
40-inch 2.48-yard	.10⅛
40-inch 2.56-yard................	.09¼
40-inch 3.00-yard................	.08⅝
40-inch 7-ounce part waste......	.08⅞
40-inch 10-ounce part waste......	.12¼
37-inch 2.42-yard	.10⅜
Raincoat Fabrics	
Cotton	
Bombazine 60 x 64........yd.	.08¾
Plaids 60 x 48................	.11½
Surface prints 60 x 64........	.12¾
Print cloth, 38½-inch, 60 x 64.	.05½
Sheetings, 40-Inch	
48 x 48, 2.50-yard.........yd.	.09
64 x 68, 3.15-yard............	.08½
56 x 60, 3.60-yard............	.07½
44 x 40, 4.25-yard............	.06¼
Sheetings, 36-Inch	
48 x 48, 5.00-yard.........yd.	.05¼
44 x 40, 6.15-yard............	.04¼
Tire Fabrics	
Builder	
17¼ ounce 60" 23/11 ply Karded peeler ....lb.	.29
Chafer	
14 ounce 60" 20/8 ply Karded peeler ....lb.	.29
9¼ ounce 60" 10/2 ply Karded peeler ....lb.	.28
Cord Fabrics	
23/5/3 Karded peeler, 1 1/16" cotton ....lb.	.29½
15/3/3 Karded peeler, 1 1/16" cotton ....lb.	.27½
12/4/2 Karded peeler, 1 1/16" cotton ....lb.	.26½
23/5/3 Karded peeler, 1¼" cotton ....lb.	.35
23/5/3 Combed Egyptian....lb.	.48½
Leno Breaker	
8¼ ounce and 10¼ ounce 60" Karded peeler ....lb.	.31

Rubber Trade Inquiries

The inquiries that follow have already been answered; nevertheless they are of interest not only in showing the needs of the trade, but because of the possibility that additional information may be furnished by those who read them. The Editor is therefore glad to have those interested communicate with him.

No.	Inquiry
2680	Suppliers of liquid rubber for molding purposes.
2681	Suppliers of reclaimed rubber.
2682	Manufacturer of "Y" Absorbent Oil.
2683	Manufacturers of molds for rubber toys, etc.
2684	Suppliers of rubber tubing die colors.
2685	Manufacturers of garments for ambulance work, impervious to poison gas.

New York Cotton Exchange Week-End Closing Prices

Futures	July 29	Aug. 26	Sept. 2	Sept. 9	Sept. 16	Sept. 23
Sept.	9.00	8.64	8.37	9.01	....	....
Oct.	....	....	8.37	9.02	9.10	9.01
Dec.	8.81	8.43	8.18	8.95	8.85	8.73
Mar.	8.56	8.23	8.01	8.85	8.61	8.56
July	8.31	7.93	7.72	8.60	8.25	8.15

THE accompanying table of week-end closing prices on the New York Cotton Exchange shows the week-end change of representative futures covering the past two months.

The cotton market advanced briskly upon war news during the first week of September, but fell off during the balance of the month. The New York spot middling price closed at 8.94¢ per pound on September 1, advanced to 10¢ per pound on September 7, and thereafter was easier, closing at 9.27¢ on September 28.

Consumption of cotton, excluding linters, in the United States during August was reported by the Census Bureau to have totaled 628,448 bales, against 521,405 in July and 559,409 in August, 1938. August, 1939, exports were 218,792 bales, against 106,531 in July and 200,843 in August last year. Stocks of cotton in consuming establishments at the end of August were 653,874 bales, a total held insufficient to meet the needs of September alone.

Exports during the latter part of September were especially large to Great Britain, but they included a substantial amount of "barter" cotton to be exchanged for British rubber.

On September 8 the Crop Reporting Board, Department of Agriculture, estimated cotton production from this year's crop at 12,380,000 bales, up 968,000 bales from the estimate of August 8.

Hopes for a world-wide control program for cotton production and marketing received a setback when foreign delegates to a Washington conference last month indicated that their governments would not restrict acreage although they expressed some willingness to cooperate.

Fabrics

The markets for cotton textiles of coarse yarn construction experienced during September the most active demand known for many years. Most mills have disposed of the bulk of their stocks, and the majority have orders enough to keep them busy until the end of the year. It was also noted that most mills were reluctant to accept orders for delivery in 1940. The trade felt that the war abroad would continue and that domestic mills would be called upon to supply markets formerly taken care of by Great Britain, Germany, and France. The fall raincoat business is now in progress, and manufacturers report good trade with children's raincoats leading the field.

The increased demand was reflected in a strong market, and all types of cloth construction advanced substantially in price over last month's levels.

Goodyear to Build

(*Continued from page* 100)

As heretofore, Mr. Cameron will oversee the functions of distribution. G. K. Hinshaw, formerly chief chemist, will oversee production operations and deal directly with superintendents of plants outside the United States, including tire factories in England, Australia, Sweden, Argentina, Brazil, Java, and Canada.

Financial matters will be under the direction of Mr. Howard, recently returned from several years' service in the Australian organization. C. L. Weberg will oversee all comptroller's functions, and C. A. Failing all legal functions.

Also effective September 1, the functions of the development, the research, and the machine design departments at Akron were consolidated in one division, with W. S. Wolfe as its head and R. P. Dinsmore as assistant manager, who will carry on the work of the division which he has been supervising besides taking care of the duties formerly handled by Mr. Hinshaw.

Rhode Island Rubber Club

Meeting at the Wannamoisett Country Club, Rumford, R. I., on September 22, the Rhode Island Rubber Club, with 59 in attendance, elected the following officers for the ensuing year: president, David C. Scott, Jr.; secretary-treasurer, John Marshall, Jr.; executive board, Daniel Rhee, F. S. Bartlett, F. P. Jecusco, A. J. Davis, Franklin Springer, S. J. Lake, Roy Edson, Charles Berlow, and Lawrence K. Youse.

Preceding the meeting and dinner in the evening, 34 members and guests enjoyed an afternoon of golf. The speaker for the evening was Roger Oake, of Brown University, Providence, R. I., who spoke on the current European struggle. Mr. Oake, who has spent much time in Poland, centered his discussion on the Eastern front.

Rubber Group Meetings

October 3. Los Angeles Group, Rubber Division, A.C.S., Mayfair Hotel. Los Angeles, Calif.

October 20. New York Group, Rubber Division, A.C.S., Building Trades Employers Association, Two Park Ave., New York, N. Y. Awarding of prizes for essay contest and reading of prize-winning papers.

F. A. Seiberling, dean of the rubber industry and chairman of the board of the Seiberling Rubber Co., Akron, O., which he founded 18 years ago, celebrates his eightieth birthday on October 6. Although he relinquished his active executive duties two years ago next February, Mr. Seiberling still is at his desk almost daily serving in an advisory capacity.

Since 1845

THE VELOCIPEDE MANIA—WHAT IT MAY COME TO!—[Drawn by Thomas Worth.]

Back in the days when these were Streamliners

We started our business of the manufacture and sale of cotton fabrics in 1845. Since then the great rubber industry as we know it today has come a long way—and since then, we in our turn have kept pace with the rubber industry's progress as well as with the progress of all industry.

Today we distribute over 25,000 different cotton fabrics — the products of 17 of the most modern mills in America. Our organization includes centralized laboratory and textile engineering services that are second to none.

The wide-spread use of our products by leaders in the rubber industry is an excellent indication of their reliability and their quality.

The facilities of our laboratories and our mills as well as the experience of our textile engineers are at the disposal of the rubber industry for any future developments.

WELLINGTON SEARS COMPANY

65 WORTH STREET NEW YORK, N. Y.

Patents and Trade Marks

MACHINERY

United States

2,168,555. **Continuous Conveying Apparatus.** H. T. Battin, Ridgewood, N. J., assignor by mesne assignments, to United States Rubber Co., New York, N. Y.

2,168,588. **Collapsible Segmental Former.** H. Smith, Sutton Coldfield, and H. Taylor, Birmingham, assignors to Dunlop Rubber Co., Ltd., London, all in England.

2,168,897. **Tire Building Drum.** H. C. Bostwick, Coventry Township, assignor to Akron Standard Mold Co., Akron, both in O.

2,169,146. **Molding Presses.** C. Iverson, assignor to National Rubber Machinery Co., both of Akron, O.

2,169,303. **Filament Producing Apparatus.** F. J. Tobias, Allentown, Pa., assignor, by mesne assignments, to Filatex Corp., New York, N. Y.

2,169,886. **Rubber Thread Machine.** K. R. Shaw, assignor to Easthampton Rubber Thread Co., both of Easthampton, Mass.

2,170,396. **Mill Pan Temperature Controller.** F. H. Banbury, Woodmont, assignor to Farrel-Birmingham Co., Inc., Derby, both in Conn.

2,171,424. **Tire Carcass Expander.** W. J. Breth, Akron, and W. C. McCoy, Shaker Heights, assignors to General Tire & Rubber Co., Akron, both in O.

Dominion of Canada

383,536. **Mold.** Brown Co., assignee of M. O. Schur, both of Berlin, N. H., U. S. A.

United Kingdom

503,438 and 503,457. **Belt Vulcanizer.** A. H. Stevens, (Boston Woven Hose & Rubber Co.).

503,675. **Drawing Fiber Apparatus.** United States Rubber Products, Inc.

503,757. **Milking Apparatus.** Avon India Rubber Co., Ltd., and K. B. Kilborn.

Germany

679,930. **Device and Method to Cover Rollers with Rubber.** Stowe-Woodward Inc., Newton, Mass., U. S. A. Represented by F. Meffert, L. Sell, and E. Schlumberger, all of Berlin.

PROCESS

United States

2,168,523. **Treating Plants.** (Latex). G. E. Heyl, Mill Hill, London, England.

2,168,583. **Package Wrapping.** W. A. Ringler, Wayne, Pa., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,169,062. **Surface-Treating Labeled Articles.** T. H. Way, Montreal, P. Q., Canada, assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,169,225. **Protective Coating.** L. G. Copeman, assignor to Copeman Laboratories Co., both of Flint, Mich.

2,169,288. **Casting Thin Film.** R. S. Reynolds, Glen Cove, N. Y.

2,169,378. **Valve Stem.** S. T. Williams, Bellerose, N. Y.; assignor to Scovill Mfg. Co., Waterbury, Conn.

2,169,475. **Rubber Article.** A. N. Spánel, Rochester, N. Y.

2,169,847. **Rubber Structure.** (Latex). E. A. Murphy, Birmingham, G. W. Trobridge, Sutton Coldfield, and A. N. Ward, Birmingham, assignors to Dunlop Rubber Co., Ltd., London, all in England.

2,170,043. **Coating Process.** (Latex). G. W. Worrall, Norwich, England, assignor to Imperial Chemical Industries, Ltd., a corporation of Great Britain.

2,170,441. **Rubber Strips.** R. W. Albright, assignor to American Anode, Inc., both of Akron, O.

2,170,919. **Rubber Article.** A. F. Thener, assignor to Cupples Co., both of St. Louis, Mo.

2,171,118. **Tennis Ball Covering.** S. G. Ball, Streetly, England, assignor to Dunlop Tire & Rubber Corp., Buffalo, N. Y.

2,171,236. **Knitting Process.** J. L. Getaz, Maryville, Tenn.

2,171,389. **Lacquer Coating Flexible Materials.** S. J. Blaupot ten Cate, Kootwijk, Netherlands.

2,171,438. **Tire Tread.** J. P. Tarbox, assignor to E. G. Budd Mfg. Co., both of Philadelphia, Pa.

2,171,445. **Knitting Fabric with Elastic Inlay.** J. L. Getaz, Maryville, Tenn.

Dominion of Canada

383,361 and 383,362. **Rubber Process.** T. L. Shepherd, London, England.

383,429. **Elastic Fabric.** (Latex). International Latex Processes, Ltd., St. Peter's Port, Channel Islands, assignee of T. G. Hawley, Jr., Naugatuck, Conn., U. S. A.

383,577. **Hot-Dipping Metal Objects.** National-Standard Co., assignee of E. C. Domm, both of Niles, Mich., U. S. A.

United Kingdom

503,564. **Beauty Mask.** E. Field and I. Goodchild.

503,712. **Bathing Cap.** I. B. Kleinert Rubber Co.

504,047. **Stretching Yarn.** Barmer Maschinenfabrik A.G.

504,068. **Belt Fastening.** Continental Gummi-Werke A.G.

504,232. **Valve.** (Latex). International Latex Processes, Ltd.

504,250. **Vulcanizing Hose.** A. L. Wallace.

504,466. **Sheet and Thread.** (Latex and Synthetic Rubber). E. I. du Pont de Nemours & Co., Inc.

504,467. **Coagulating Latex.** (Latex and Synthetic Rubber). E. I. du Pont de Nemours & Co., Inc.

504,597. **Wheel Tire.** L. Betz.

504,858. **Compound Sheet Material.** (Latex). United States Rubber Products, Inc.

Germany

680,517. **Objects from Aqueous Dispersions of Rubber.** Dunlop Rubber Co., Ltd., London, England, and Anode Rubber Co., St. Peter's Port, Channel Islands. Represented by C. and E. Wiegand, both of Berlin.

CHEMICAL

United States

2,168,576. **Rubber Colors.** G. Niemann and L. Kollek, both of Ludwigshafen-on-the-Rhine, Germany, assignors to General Aniline Works, Inc., New York, N. Y.

2,168,808. **Accelerator.** F. K. Schoenfeld, Silver Lake Village, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,169,618. **Rubber Preservative.** R. L. Sibley, Nitro, W. Va., assignor, by mesne assignments, to Monsanto Chemical Co., St. Louis, Mo.

2,169,918. **Lubricant.** A. J. Kraus, assignor to Richards Chemical Works, Inc., both of Jersey City, N. J.

2,170,037. **Accelerator.** W. L. Semon, Silver Lake Village, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,170,059. **Mercaptothiazolines.** R. A. Mathes, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,170,191. **Vulcanizing Agents.** H. L. Fisher, Leonia, N. J., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,170,453. **Vulcanizing Agent.** M. W. Harman, Nitro, W. Va., assignor to Monsanto Chemical Co., St. Louis, Mo.

2,170,947. **Composition for Bonding Neoprene and Rubber.** (Synthetic Rubber). B. J. Habgood and L. B. Morgan, both of Manchester, England, assignors to Imperial Chemical Industries, Ltd., a corporation of Great Britain.

2,170,949. **Adhesive.** W. L. Morgan, Hammond, Ind., assignor to Sylvania Industrial Corp., Fredericksburg, Va.

2,171,305. **Accelerator.** M. W. Harman, Nitro, W. Va., assignor, by mesne assignments, to Monsanto Chemical Co., St. Louis, Mo.

2,171,395. **Rubber Reaction Product.** E. H. Farmer, Hertfordshire, and H. P. Stevens and J. W. Rowe, both of London Bridge, assignors, by mesne assignments, to British Rubber Producers' Research Association, London, all in England.

2,171,421. **Vulcanizing Agent.** I. Williams, Woodstown, N. J., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

United Kingdom

503,186. **Fireproof Rubber Compounds.** T. Uski.

503,399. **Artificial Latex.** (Latex). Dispersions Process, Inc.

503,503. **Adhesive for Covered Elastic Threads.** S. C. Lilley.

504,004. **Accelerator.** Wingfoot Corp.

504,041. **Halogenated Rubber Compositions.** Standard Oil Development Co.

504,480. **Fireproofing Compounds.** Etablissements Bouillon Frères.

504,549. **Microporous Composition.** United States Rubber Products, Inc.

504,568. **Artificial Rubber.** G. E. Scharff and Imperial Chemical Industries, Ltd.

504,583. **Accelerator.** Wingfoot Corp.

504,684. **Accelerators.** Wingfoot Corp.

Dominion of Canada

383,457. **Lubricant.** Texaco Development Corp., Wilmington, Del., assignee of C. C. Towne, Beacon, N. Y., both in the U. S. A.

Germany

680,478. **Rubber Conversion Products.** Goodyear Tire & Rubber Co., Akron, O., U. S. A. Represented by W. Meissner and H. Tischer, both of Berlin.

GENERAL

United States

2,168,328. **Airplane Deicing Means.** W. S. Diehl, United States Navy.

2,168,353. **Hydrometer.** C. E. Linebarger, assignor to Chaslyn Co., both of Chicago, Ill.

2,168,366. **Tube for Battery Electrodes.** G. Slayter, Newark, O., assignor, by mesne assignments, to Owens-Corning Fiberglas Corp., a corporation of Del.

2,168,437. **Injection Device.** K. O. Buercklin, St. Louis, Mo.

2,168,514. **Safety Tube.** B. Darrow, Akron, O.

2,168,659. **Steering Gear.** B. W. Twyman, assignor to Lavine Gear Co., both of Milwaukee, Wis.

2,168,690. **Air Control Device.** W. J. Uksila, Spokane, Wash.

2,168,868. **Ornamented Fabric.** J. L. Getaz, Maryville, Tenn.

2,168,900. **Wheel.** B. H. Eaton, Los Angeles, Calif.

2,168,945. **Swimming Cap.** I. F. Redwine, Waltham, Mass.

2,168,949. **Stratiform Structure.** E. Bentz, Koblenz, and J. Jaenicke, Frankfurt a.M., assignors to Gewerkschaft Keramchemie-Berggarten, Siershahn, Westerwald, Germany.

2,169,037. **Tire.** J. E. Cady, Indianapolis, Ind., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,169,041. **Tire.** J. R. Gammeter, Akron, O., assignor to United States Rubber Co., New York, N. Y.

2,169,091. **Socket.** F. C. De Reamer, Bridgeport, Conn., assignor to General Electric Co., a corporation of N. Y.

2,169,145. **Furniture Cushion Slide.** W. F. Herold, assignor to Bassick Co., both of Bridgeport, Conn.

2,169,203 and 2,169,204. **Stocking.** E. C. Hinchliff, assignor to Burson Knitting Co., both of Rockford, Ill.

2,169,206. **Windshield and Window Cleaner.** S. Krongold, Uniontown, Pa.

2,169,259. **Garter.** H. W. Lakin, Boston, Mass.

2,169,283. **Drilling Apparatus.** J. W. Pippin, Corpus Christi, Tex.

2,169,503. **Window Mounting.** C. F. Schlegel, Brighton, assignor to Schlegel Mfg. Co., Rochester, both in N. Y.

2,169,585. **Foundation Garment.** W. Kops, assignor to Kops Bros., Inc., both of New York, N. Y.

2,169,619. **Stenciling Machine.** J. C. Smith, assignor to Solar Laboratories, both of Beaver, Pa.

2,169,623. **Belt Conveyer and Idler.** C. R. Weiss and R. W. Parker, both of Indianapolis, Ind., assignors to Link Belt Co., a corporation of Ill.

2,169,624 and 2,169,625. **Belt Conveyer Idler.** C. R. Weiss and R. W. Parker, both of Indianapolis, Ind., assignors to Link Belt Co., a corporation of Ill.

2,169,782. **Cotton Cleaner.** H. T. Ahrens, Charlotte, Tex.

2,169,784. **Artificial Respiration Apparatus.** A. C. N. Andersen, Odense, Denmark.

2,169,905. **Intestine Cleaner.** L. Sevek, Omaha, Nebr.

2,169,939. **Swimming Glove.** F. L. Anderson, Bristol, Tenn.

2,170,131. **Telephone Plug.** C. W. Doremus, Washington, D. C.

2,170,181. **Elastic Pipe Joint.** M. C. Allen, Mercedes, and R. G. Shelley, Donna, both in Tex.

2,170,236. **Umbrella Drip Catcher.** C. D. De Lamater, San Diego, Calif.

2,170,242. **Fountain Pen.** B. W. Hanle, Elizabeth, N. J., assignor to Eagle Pencil Co., a corporation of Del.

2,170,264. **Windshield Cleaner.** E. C. Horton, Hamburg, assignor to Trico Products Corp., Buffalo, both in N. Y.

2,170,281. **Cabinet Syringe.** R. C. Snow, New York, N. Y.

2,170,393. **Device to Connect Cable to Box.** N. A. Tornbloom, Chicago, Ill., assignor to Appleton Electric Co., a corporation of Ill.
2,170,415. **Rain Shield for Gasoline Tanks.** L. Karell, Brooklyn, N. Y.
2,170,439. **Elastic Fiber.** P. J. Wiezevich, Elizabeth, N. J., now by judicial change of name to P. J. Gaylor, assignor to Standard Oil Development Co., a corporation of Del.
2,170,442. **Twitch.** H. F. Banholzer, Chicago, Ill.
2,170,539. **Balloon.** G. E. Schoberg, Minneapolis, Minn.
2,170,563. **Elastic Fabric.** H. F. Lord, assignor to J. W. Wood Elastic Web Co., both of Stoughton, Mass.
2,170,565. **Wheel Spring Suspension.** C. Macbeth, Birmingham, England.
2,170,574. **Hydraulic Seal.** C. Sauzedde, assignor to Detroit Hydrostatic Brake Corp., both of Detroit, Mich.
2,170,647. **Wheel Construction.** C. S. Ash, Milford, assignor to Kelsey-Hayes Wheel Co., Detroit, both in Mich.
2,170,652. **Shoe Protector during Cleaning.** M. M. Brennan, Chicago, Ill.
2,170,718. **Rod-Supporting Bushing.** L. E. Humphries, Balmorhea, Tex.
2,170,848. **Wheel Balance Tester.** C. C. Bennett, South Bend, Ind., assignor to A. E. Feragen, Inc., Seattle, Wash.
2,170,915. **Collar Passing Pressure Stripper.** F. J. Schweitzer, Orange, Calif.
2,171,012. **Hose Supporter.** W. J. Spencer, Chicago, Ill.
2,171,023. **Faucet Extension.** J. Buxton, Hawthorne, Calif.
2,171,049. **Oil Well Packer Shoe.** J. T. Simmons, Casper, Wyo., assignor to Halliburton Oil Well Cementing Co., Duncan, Okla.
2,171,053. **Fishing Rod and Ski Clamp and Carrier.** R. White, Lynwood, and W. C. Daniels, Huntington Park, both in Calif.; said Daniels assignor to said White.
2,171,055. **Belt and Connector.** A. L. Freedlander, assignor to Dayton Rubber Mfg. Co., both of Dayton, O.
2,171,140. **Adhesive Sheet.** R. T. K. Cornwell, Spotsylvania, assignor to Sylvania Industrial Corp., Fredericksburg, both in Va.
2,171,149. **Resilient Mounting.** K. and H. O. Schröter, both of Wechmar, Gothaland, Germany.
2,171,191. **Windshield Frame Structure.** A. T. Potter, assignor to Ainsworth Mfg. Co., both of Detroit, Mich.
2,171,354. **Undergarment.** C. Bullinger, Riverside, assignor to A. Stein & Co., Chicago, both in Ill.
2,171,382. **Golf Club Grip.** W. L. Wettlaufer, Buffalo, N. Y.
2,171,393. **Windscreen Wiper.** J. Burnside, Glasgow, Scotland.
2,171,419. **Artificial Leather.** M. O. Schur and B. G. Hoos, assignors to Brown Co., all of Berlin, N. H.

Dominion of Canada

383,017. **Display Package.** L. L. Salfisberg, South Orange, N. J., U. S. A.
383,024. **Vibrator.** J. L. Wettlaufer, Toronto, Ont.
383,040. **Hair Curler.** Apex Products, Ltd., Toronto, Ont., assignee of J. Goodman, New York, N. Y., U. S. A.
383,080. **Shoe Part Connecting Means.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of E. W. Herzog and C. J. Futter, co-inventors, both of Mishawaka, Ind., U. S. A.
383,082. **Bottle Capper.** E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., assignee of E. N. Winslow, Shaker Heights, O., both in the U. S. A.
383,090. **Foundation Garment.** H. W. Gossard Co., assignee of H. Wipperman, both of Chicago, Ill., U. S. A.
383,103. **Frozen Confectionery Forming Apparatus.** Joe Lowe Corp., assignee of N. M. Thomas, both of New York, N. Y., U. S. A.
383,124. **Wiper Arm.** Trico Products Corp., Buffalo, assignee of E. C. Horton, Hamburg, both in N. Y., U. S. A.
383,169. **Article Support.** D. K. Copell, New York, N. Y., U. S. A.
383,182. **Drill.** R. Jennings, Montreal, P. Q.
383,192. **Horse Shoe Pad.** F. J. Marsh, Riccarton, Christchurch, New Zealand.
383,219. **Shoe Protective Cover.** Boston Blacking Co. of Canada, Ltd., Montreal, P. Q., assignee of S. M. Griswold, Boston, Mass., U. S. A.
383,256 **Vehicle Cushioned Connection.** B. F. Goodrich Co., New York, N. Y., assignee of F. L. Haushalter, Akron, O., both in the U. S. A.
383,309 and 383,310. **Transparent Fabric.** Winterbottom Book Cloth Co., Ltd., Manchester, assignee of G. E. Pilkington, Halebarns, and T. L. Dale, Heaton Mersey, co-inventors, all in England.
383,319. **Windshield Wiper Blade.** R. A. Rodrick, Akron, O., U. S. A.
383,360. **Anti-Skid Device.** A. F. Roth, Wilkes-Barre, Pa., U. S. A.
383,408. **Golf Ball.** Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont., assignee of D. F. Twiss, A. E. T. Neale, and L. A. Bradbury, co-inventors, all of Birmingham, England.
383,420. **Refrigerating Plant.** Gebrüder Zehnder Radiatoren- & Apparatebau, assignee of O. Zehnder, both of Granichen, Aargau, Switzerland.
383,431 **Tire.** Lee Rubber & Tire Corp., Conshohocken, assignee of A. H. Nellen, Merion, both in Pa., U. S. A.
383,462. **Bottle Capper.** Charles Urban, Ltd., London, England, assignee of E. Pommer, Vienna, Germany.
383,504. **Safety Valve.** P. E. Perman, Stockholm, Sweden.
383,506. **Hair Curler.** N. L. Solomon, New York, N. Y., U. S. A.
383,509. **Tire Remover.** G. Van Zale, Bay City, Mich., U. S. A.
383,555. **Valve Stem.** Dill Mfg. Co., Cleveland, assignee of A. E. Bronson, Shaker Heights, and W. F. Goff, Akron, co-inventors, all in O., U. S. A.
383,580. **Anesthetic Administration Apparatus.** Ohio Chemical & Mfg. Co., assignee of J. G. Sholes, both of Cleveland, O., U. S. A.
383,581. **Belt.** Owens Illinois Glass Co., Toledo, assignee of G. Slayter and J. LeR. Tucker, co-inventors, both of Newark, both in O., U. S. A.
383,589. **Coupling.** Renold & Coventry Chain Co., Ltd., assignee of J. K. Byrom, both of Manchester, England.

United Kingdom

502,467. **Collar-Stud Retainer.** J. Landgraber.
502,494. **Luggage Carrier.** G. Lavanchy.
502,513. **Ore Sintering Apparatus.** Metallges. A.G.
502,531. **Oxygen Tent.** Tor Equipment Co., Ltd., B. Monk, and H. J. Rickwood.
502,537. **Rock Drill.** C. C. Whitson.
502,610. **Collapsible Tube Closure.** A. H. Church.
502,624. **Box.** E. F. Coote and Nathan's Sales, Ltd.
502,627. **Cable Casing.** G. Carpenter and Electric Hose & Rubber Co., Ltd.
502,634. **Holder for Reel of Tape.** B. B. Bishop.
502,643. **Compound Sheet Packing.** (Synthetic Rubber). United States Rubber Products, Inc.
502,654. **Vehicle Radiator.** L. H. Jackson.
502,681. **Balloon Fabrics.** (Synthetic Rubber). W. Baker and Imperial Chemical Industries, Ltd.
502,729. **Machine for Working Kapok.** C. N. Mims and J. Pitt.
502,746. **Pipe Joint.** W. H. Scheidt.
502,765. **Gas Mask Filter.** Soc. Italiana Pirelli.
502,776 **Pipe Joints.** Harris Products Co.
502,932 **Cable.** E. B. Robinson, (Kabushikikaisha Sumitomo Densen Seizosho Sumitomo Electric Wire & Cable Works, Ltd.).
502,949. **Ball Mill.** F. Krupp Grusonwerk A.G.
502,981. **Teething Device.** P. E. Allen
502,992. **Tire Tread.** B. Nowak.
502,998. **Footwear.** Fabbriche Riunite Industria Gomma Torino W. Martiny Industria Gomma-Spiga-Sabit-Life.
503,033. **Inkstand.** L. Briers.
503,047. **Ball.** Dunlop Rubber Co., Ltd., and D. F. Twiss.
503,075 **Riveting Machine.** A. C. Hicks and Sandholme Iron Co., Ltd.
503,119. **Endless Tracks for Vehicles and Skates.** Soc. Industrielle D'Auteuil Soc. Anon.
503,120. **Handkerchief.** M. Feiler.
503,143. **Bottle.** E. Kirmes.
503,153. **Vehicle Lamp Mounting.** J. Lucas, Ltd., O. Lucas, and R. L. Neill.
503,175. **Rectal Appliance.** A. Sinclair, trading as A. W. Sinclair.
503,237. **Handle Bars.** H. W. Neale.
503,259. **Cigarette Making Machine.** American Machine & Foundry Co.
503,270. **Wheel.** Dunlop Rubber Co., Ltd., and G. E. Sharp.
503,274 **Tire Remover and Replacer.** A. Sedlackova.
503,284. **Universal Joint.** P. Koppe.
503,311. **Spray Producer.** W. G. Regters.
503,341. **Vehicle Spring Suspension.** C. Macbeth.
503,355. **Draught Excluder.** Soc. Mesnel Freres.
503,356. **Transfer.** (Latex). H. Dachinger.
503,368. **Battery Lamp.** A. H. Stevens, (Justrite Mfg. Co.).
503,374. **Ink-Ribbon Mechanism.** B. J. Bennett.
503,432. **Fuel Injector.** Bryce, Ltd., and G. W. A. Green.
503,445. **Vibration Damper.** W. B. Buchanan and G. B. Tebo.
503,472. **Sliding Door Rail.** Educational Supply Association, Ltd., and J. W. Leonard.
503,500. **Collapsible Tube.** A. Brosette.
503,505. **Reflecting Blocks and Guard Rails for Roads.** S. M. Lovell.
503,514. **Mounting Motor.** F. Maier.
503,525. **Shoe Gore.** R. T. Dawes.
503,537. **Jewelry Mold.** J. G. Jungersen.
503,565. **Plier.** Siemens Bros. & Co., Ltd., and E. F. Guest.
503,603 **Molding Concrete Blocks.** A. E. Ruegg.
503,637. **Mattress.** J. E. L. Marshall.
503,640. **Closure.** F. B. Leedham.
503,641. **Printing Press.** G. C. Waters.
503,662. **Fruit Stoning Machine.** G. Frova.
503,663. **Knitted Fabric.** N. Corah & Sons, Ltd., R. L. Wessel, and L. G. Green.
503,667. **Shafts or Rollers.** A. H. Stevens (C. G. Watson).
503,684. **Electrolytic Condenser.** (Latex). A. H. Hunt, Ltd., and J. H. Fisher.
503,696. **Shock Absorber.** P. S. Baldwin.
503,700. **Collar and Cuff Stiffener.** M. B. Ballart.
503,709. **Cycle Stand.** H. E. Kettle.
503,719. **Tire Damage Indicator.** S. Hirsch.
503,726. **Vacuum Cleaner.** British Thomson-Houston Co., Ltd.
503,745. **Damping Roller.** C. W. Jones.
503,799. **Ventilator.** A. E. Dutfield, E. J. Rawlings, and Rawlings Mfg. Co., Ltd.
503,801. **Bath Closure Device.** A. G. Westmoreland.
503,804. **Hinge.** Bromford Tube Co., Ltd., and M. Reimann.
503,842. **Hydraulic Power Transmission.** India Rubber, Gutta Percha & Telegraph Works Co., Ltd., F. J. Tarris, and D. Webb.
503,922. **Dart Board.** A. C. Aston.
503,958 **Box.** L. Hutton & Co. (Windermere), Ltd., and A. F. Whittle.
503,961. **Brush.** A. B. and W. J. Frame.
503,974. **Laminated Rubber-Chlorinated Rubber Sheet.** Wingfoot Corp.
503,998. **Catamenial Appliance.** R. O. Astengo and D. Tavani.
504,006. **Vacuum Chamber.** A. A. Henkel.
504,016. **Bronzed Coating.** W. V. Gilbert.
504,038. **Safety Fuse.** Imperial Chemical Industries, Ltd.
504,058. **Vacuum Cleaner.** M. Wheeldon.
504,079. **Centrifugal Separator.** J. and A. Persoons.
504,111. **Container Closure.** (Latex). Dewey & Almy, Ltd., (Dewey & Almy Chemical Co.).
504,124. **Swimming Pool Coating.** (Latex). W. W. Triggs, (Naamlooze Vennootschap Hollandsche Ingenieurs Mij.).
504,144. **Mounting Motor.** Firestone Tire & Rubber Co., Ltd.
504,154. **Golf Practising Appliance.** H. V. Chapman.
504,167. **Tire Groover.** O. Muller.
504,187. **Hand Stamp.** H. Cossmann, and Decotric A.G.
504,226. **Ice Making Tray.** General Motors Corp.
504,266. **Press.** A. Fischer-Schmutz.
504,288. **Knee and Elbow Pad.** Dunlop Rubber Co., Ltd., and G. B. Ainsworth.
504,303. **Jar Closure.** Canning Town Glass Works, Ltd., and J. S. Franklin.
504,313. **Mat.** R. Wineberg.
504,355. **Blocks.** W. T. Graves and Improved Wood Pavement Co., Ltd.
504,377. **Screw Propeller.** De Havilland Aircraft Co., Ltd., and E. P. King.
504,381. **Cavitied Article Mold.** F. Humphris.
504,387. **Ball.** W. Sykes, Ltd., and W. J. Wycherley.
504,404. **Valve.** Dunlop Rubber Co., Ltd., J. Wright, and H. Trevaskis.
504,407. **Washing Machine.** J. Carroll and B. Kobre.
504,422. **Cable.** Standard Telephones & Cables, Ltd.
504,423. **Float.** Dornier-Werke Ges. and C. Dornier.
504,447. **Motorcycle Wheel Spring Mounting.** Phanomen-Werke G. Hiller A.G.
504,482. **Battery.** Young Accumulator Co., Ltd., H. De Martis, and S. J. Clark.
504,485. **Removing Fragments from Containers.** Canning Town Glass Works, Ltd., and J. J. Parnaby.
504,524. **Compound Sheet Material.** (Latex). J. Pichette.
504,550. **Joint.** H. P. Smith.
504,570. **Road Joint.** B. F. Goodrich Co.
504,582. **Coupling.** Firestone Tire & Rubber Co., Ltd.
504,589. **Welding.** Hume Steel, Ltd.
504,638. **Joint Wrapping.** Newport (Mon.) Gas Co. and C. B. Felton.
504,645. **Dry Shaver.** Wilkinson Sword Co., Ltd., H. B. Randolph, and A. Mathisen.
504,670. **Cable.** Callender's Cable & Construction Co., Ltd., and G. M. Hamilton.
504,720. **Cable.** Standard Telephones & Cables, Ltd., T. R. Scott, and J. K. Webb.
504,729. **Universal Joint.** Hardy, Spicer & Co. and J. A. Daniell.
504,748. **Electrolytic Condenser.** Dubilier Condenser Co. (1925), Ltd., and J. H. Cotton.
504,764. **Heat Exchanger Tubes.** Superheater Co., Ltd., and M. T. Pickstone.
504,769. **Facial Stretching Means.** I. Henry.
504,813. **Gas-Mask Eyepieces.** J. A. Audy.
504,817. **Road Marking Block.** P. Shaw.
504,827. **Gas-Mask Eyepieces.** R. Romer.
504,857. **Valve.** G. Thiman.
504,896. **Mop.** R. K. Metcalf.
504,904. **Boxing Glove.** F. H. Sutherland.
504,919. **Engine Mounting.** Leyland Motors, Ltd., J. T. Naylor, and J. D. Coldwell.
504,954. **Bottle Closure.** International Bottle Co., Ltd., and W. Bennett.
504,962. **Cutlery Case.** J. A. Morton.

504,985. **Corset.** B. Dawson.

505,043. **Filter-Press.** R. Seligman and Aluminum Plant & Vessel Co., Ltd.

505,061. **Tire Inflater.** W. Turner.

505,089. **Cellulose Rubber Tubes.** K. Bratring and International Containers, Ltd.

505,094. **Aircraft De-Icer.** Dunlop Rubber Co., Ltd., J. Wright, and H. Trevaskis.

505,136. **Chair-Pad.** (Synthetic Rubber). A. H. Stevens, (Resilient Products Corp.).

505,138. **Collapsible Tube.** H. W. W. Owen.

505,158. **Brush.** A. H. Timmis and Hamilton & Co. (London), Ltd.

505,185. **Screw Propeller.** W. Caine.

505,223. **Abrasive Wheel.** Norton Grinding Wheel Co., Ltd.

505,257. **Toy Airplane.** W. Rigby.

505,273. **Cleaning by Electrolysis.** J. G. Quiros-Worledge and A. Hoore.

505,300. **Valve.** M. A. Sertillange.

505,313. **Railway Crossing.** T. P. Strickland and A. T. O'Meara.

505,454. **Seamed Joints.** (Latex). P. Bogner and W. Liebel.

505,469. **Spray Producer.** H. S. Hodgkinson.

505,866. **Bending Machine.** G. G. M. Dechaux.

Germany

680,362. **Shoe.** Continental Gummi-Werke A.G., Hannover.

680,407. **Flower Pot Cover.** K. Rab and K. Walter, both of Vienna.

680,504. **Time Switch.** E. and R. Uriga, Berlin.

680,529 and 680,530. **Elastic Fabric.** Firma Hch. Kalbskopf, Munchberg.

TRADE MARKS

United States

368,992. **Siloewok-Sawangan.** Rubber. N. V. Cultuur Maatschappy Siloewok Sawangan, Samarang, West Java, Netherland India.

369,077. **Tire Life.** Tire and tube patches and rubber solvent therefor. H. E. Engert, doing business as Victor Patch Co., Chicago, Ill.

369,132. **Rayo-Cord.** Tires. General Tire & Rubber Co., Akron, O.

369,167. **Ozuriet.** Electric cables, wires, and cords, materials and supplies for mounting them, and insulating coverings. N. V. Hollandsche Draad-En Kabelfabriek, Amsterdam, Netherlands.

369,184. **Rocket.** Tires and tubes. Globe Oil & Refining Co., Wichita, Kan.

369,185. **Super-Rocket.** Tires and tubes. Globe Oil & Refining Co., Wichita, Kan.

369,316. **Mainliner.** Toy train railroad ties. Essex Rubber Co., Trenton, N. J.

369,300. **Minor House.** Hose. Allied Stores Corp., Wilmington, Del., doing business as Bon Marche, Seattle, Wash.

369,386. **Firestone Latex Whip Sponge.** Sponge rubber cushions, mattresses, and padding. Firestone Tire & Rubber Co., Akron, O.

369,404. **Startex.** Tires and tubes. Apex Tire, Inc., Providence, R. I.

369,420. Representation of a streamer containing a star and the words: **"Packaged Party."** Balloons. Party Mart, Inc., New York, N. Y.

369,445. **Utility.** Tires and tubes. Globe Oil & Refining Co., Wichita, Kan.

369,454. Representation of a life preserver containing the words: **"Sea-Lastic Covered Elastic Thread, Sea Island Thread Mfg. Corp. New York,"** two men pulling thread, and an island scene with the words: **"Sea Island Sewing Thread."** Rubber covered thread. Sea Island Thread Mfg. Corp., New York, N. Y.

369,464. Representation of a double circle containing the letter: **"D."** Printing rollers. Dayton Rubber Mfg. Co., Dayton, O.

369,467. **Hiawatha.** Elastic thread. Driyz-Traum Co., Inc., New York, N. Y.

369,468. **Raycraft.** Tires and tubes. I. Spevack, doing business as Raycraft Tire & Rubber Co., Brooklyn, N. Y.

369,472. Representation of an hour glass within a double circle containing the words: **"Rockbestos"** and **"Permanently Insulated Wires and Cables."** Wires and cables. Rockbestos Products Co., New Haven, Conn.

369,529. **Sky-Hite.** Golf balls. Fisk Rubber Corp., Chicopee Falls, Mass.

369,531. **Rayosafe.** Tires. Atlas Supply Co., Newark, N. J.

369,532. **Weatherproofed.** Tires. United States Rubber Products, Inc., assignor to United States Rubber Co., both of New York.

369,586. **Fabric Boning.** Elastic piece goods. La Resista Corset Co., Bridgeport, Conn.

369,603. Representation of interlocking woven threads with a key and the words: **"Interlocken Weave."** Elastic webbing. United Elastic Corp., Easthampton, Mass.

369,654. **Selitrol.** Dental rubber. De Trey Frères Société Anonyme, Zurich, Switzerland.

369,718. **Super Insubestos.** Insulating blankets for steam turbines. Union Asbestos & Rubber Co., Cicero, Ill.

369,719. **Unibestos.** Insulating blocks and half tubular members. Union Asbestos & Rubber Co., Cicero, Ill.

369,720. **Super Unibestos.** Insulating material. Union Asbestos & Rubber Co., Cicero, Ill.

369,798. **Butyl Eight.** Accelerators. R. T. Vanderbilt Co., Inc., New York, N. Y.

369,880. **'Tops.'** Bathing caps. Barr Rubber Products Co., Sandusky, O.

369,886. **Azure.** Brassieres, corsets, garter belts, etc. Maiden Form Brassiere Co., Inc., New York, N. Y.

369,898. Representation of a label containing the words: **"Kitty Kelly."** Rubbers, etc. Kitty Kelly Shoe Corp., New York, N. Y.

369,912. **Walco Will Wear Well.** Soles. A. G. Walton & Co., Inc., Chelsea, Mass.

369,913. **Vibro-Insulator.** Machinery mountings or supports. B. F. Goodrich Co., New York, N. Y.

369,934. **Towncraft.** Suspenders and garters. J. C. Penney Co., Wilmington, Del.

369,938. Representation of a bundle of cord and the words: **"Neo-Kord."** Soles and heels. Lima Cord Sole & Heel Co., Lima, O.

369,941. **Uniweld** Footwear. Goodyear Footwear Corp., Providence, R. I.

369,945. **Durakork.** Composition soles. Panther-Panco Rubber Co., Inc., Chelsea, Mass.

369,971. Representation of a star and the words: **"All Star."** Footwear. Converse Rubber Co., Malden, Mass.

369,980. **Dura-Bond.** Rubber covered rolls and pulleys and motor mountings. Hewitt Rubber Corp., Buffalo, N. Y.

370,019. **Brite Wax.** Wax for use on rubber. Franklin Research Co., Philadelphia, Pa.

370,036. **Super 6-T.** Wires and cables. General Cable Corp., New York, N. Y.

370,049. **Fifth Avenue.** Druggists' sundries. Fred Meyer, Inc., Portland, Oreg.

370,121. **Anita-Jean.** Dress shields. McCrory Stores Corp., New York, N. Y.

370,122. Label showing silhouette of woman's head in a circle and the words: **"Anita-Jean Guaranteed Dress Shields."** Dress shields. McCrory Stores Corp., New York, N. Y.

370,138. Representation of two legendary animals holding a label containing the word: **"Vanda."** Gaskets and sheet packing. United States Rubber Co., New York, N. Y.

370,140. **Labratest.** Hot water bottles and syringes. Bloomingdale Bros., Inc., New York.

370,141. **Poppys Prophylactics.** Sheath prophylactics. Crown Rubber Co., Los Angeles, Calif.

370,143. **Crax-Par.** Golf balls. L. Bamberger & Co., Newark, N. J.

370,144. **Hi-Flex.** Tires. B. F. Goodrich Co., New York, N. Y.

370,166. The word **"General"** on a shaded background. Liquid preparations for cleaning and dressing rubber articles and for cleaning and refinishing automobile bodies, etc. General Tire & Rubber Co., Akron, O.

370,182. **Stops Quick as Lightning—Lightning Roadgripper "Silent as a Dark Night."** Tires and tubes. Pharis Tire & Rubber Co., Newark, O.

370,248. **Insubestos.** Insulating blankets. Union Asbestos & Rubber Co., Cicero, Ill.

370,277. Representation of a cave man. Resin. Hercules Powder Co., Wimington, Del.

370,278. **Hercules.** Resin. Hercules Powder Co., Wilmington, Del.

370,357. **Always Stretch.** Elastic fabrics. George C. Moore Co., Westerly, R. I.

370,369. **Moderna.** Gloves. Gimbel Bros., Inc., New York, N. Y.

370,566. Representation of the Western Hemisphere containing the word: **"Universal."** Tank balls. Sierra Rubber Co., Los Angeles, Calif.

370,610. **Hi-Miler.** Tires and tubes. Goodyear Tire & Rubber Co., Akron, O.

370,649. **Sterling.** Dress shields. I. B. Kleinert Rubber Co., New York, N. Y.

World Net Imports of Crude Rubber

Year	U.S.A.	U.K.†	Argentine	Australia	Belgium	Canada	France	Greater Germany‡	Italy	Japan	Poland	Sweden	U.S.S.R.	Rest of the World	Total
1937...	592,500	135,900	9,500	19,300	15,000	36,100	60,000	115,000	24,000	62,200	6,100	6,700	30,400	52,600	1,120,400
1938...	406,330	168,283	7,653	12,309	11,310	25,696	58,148	107,917	28,170	46,307	7,849	8,304	26,219*	49,174	927,438
1939															
Jan. ..	36,614	7,121	417	954	898	2,867	4,694	9,095	2,133	2,553	665	643	4,000*	4,284	70,653
Feb. ..	30,578	8,087	1,092	1,785	1,068	1,451	5,327	8,348	2,025	3,263	709	467	1,000*	4,824	66,710
Mar. ..	45,286	12,092	440	1,324	1,242	2,458	4,503	9,028	1,525	4,019	985	581	2,000*	4,901	86,374
Apr. ..	31,590	7,129	786	1,138	855	1,466	5,650	9,316	1,926	3,579	673	994	2,000*	4,394	69,119
May ..	45,390	10,488	353	1,202	792	3,006	4,646	9,031	1,573	4,438	940	1,047	1,000*	5,800	86,749
June ..	33,950	10,287	965	1,348	621	2,423	4,649	8,677	1,992	3,067	693	2,252	500*	4,909	74,362

*Estimated. †U. K. figures show gross imports, not net imports. ‡Including imports of Austria and Czechoslovakia. Source: *Statistical Bulletin of the International Rubber Regulation Committee.*

Shipments of Crude Rubber from Producing Countries

Year	Malaya including Brunei and Labuan	N.E.I.	Ceylon	India	Burma	North Borneo	Sarawak	Thailand	French Indo-China	Total	Philippines and Oceania	Liberia†	Other Africa	South America	Mexican Guayule	Grand Total
1937......	469,900	431,700	70,400	9,800	7,200	13,200	25,900	35,600	43,400	1,107,100	1,600*	2,300	9,100	16,300	3,400	1,139,800
1938......	372,046	298,101	49,528	8,459	6,737	9,512	17,792	41,618	59,156	862,949	1,971*	2,929	9,000*	15,337	2,758	894,944
1939																
Jan.	24,393	38,678	7,237	764	1,115	1,604	2,342	2,918	4,739	83,790	220	528	800	1,812	347	87,497
Feb.	29,278	24,996	5,495	947	618	664	1,484	5,606	5,659	74,747	158	435	800	1,187	319	77,646
Mar.	29,298	27,934	3,718	774	619	344	1,177	5,401	4,636	73,901	230	427	800	1,407	210	76,975
Apr.	29,779	28,341	2,225	881	379	1,687	2,446	2,660	2,581	70,979	135	533	800	1,206	212†	73,865
May	29,598	24,429	2,805	1,002	668	558	1,649	2,782	4,585	68,076	129	250*	800	1,077	158†	70,740
June	22,052	27,511	3,708	630	805	332	1,157	1,748	4,030	61,973	137	667	800	676	157†	64,410
July	26,013	35,727	4,908	788	503	1,603	3,092	5,599	3,367	81,600	150*	500*	800	1,071	250*	84,371

*Estimated. †Guayule rubber imports into U.S.A. and Germany provisional until export figures from Mexico are received. Source: *Statistical Bulletin of the International Rubber Regulation Committee.*

CLASSIFIED ADVERTISEMENTS

ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE

GENERAL RATES	SITUATIONS WANTED RATES	SITUATIONS OPEN RATES
Light face type $1.00 per line (ten words)	Light face type 40c per line (ten words)	Light face type 75c per line (ten words)
Bold face type $1.25 per line (eight words)	Bold face type 55c per line (eight words)	Bold face type $1.00 per line (eight words)

Allow nine words for keyed address. *Replies forwarded without charge.*

SITUATIONS WANTED

CHEMIST WITH VARIED PLANT AND LABORATORY EXPERIENCE in compounding, testing, and reclaiming. Also the preparation, analysis, and evaluation of mineral fillers. Address Box No. 24, care of INDIA RUBBER WORLD.

CHEMIST—COMPOUNDER—SUPERVISOR. FOURTEEN YEARS' experience, including all types of rubberized proofing, shoes, molded goods, sundries, acid cure, latex, and hard rubber. Address Box No. 25, care of INDIA RUBBER WORLD.

LATEX CHEMIST, CHEMICAL ENGINEER, GRADUATE COOPER Union '34. Experience compounding, thread, dipped products, etc. Wishes permanent connection. Address Box No. 27, care of INDIA RUBBER WORLD.

WORKS MANAGER — SUPERINTENDENT — AMERICAN, EMployed South America as works manager and technical adviser to manufacturers of tires, tubes, upholstery cloth, raincoat materials, mechanical goods, footwear; thorough knowledge latex chemistry, plastics molding, compounding, development, production, supervision; organize, train, and handle labor efficiently; twenty-five years' rubber and plastics manufacturing experience; accept position anywhere. Address Box No. 28, care of INDIA RUBBER WORLD.

RUBBER CHEMIST QUALIFIED FOR TECHNICAL SALES. Address Box No. 30, care of INDIA RUBBER WORLD.

MECHANICAL GOODS COMPOUNDER WITH MANAGERIAL and sales abilities. Address Box No. 31, care of INDIA RUBBER WORLD.

SITUATION OPEN

SUEDE FOREMAN TO TAKE CHARGE OF SUEDE DEPARTMENT. Must be thoroughly familiar with formulation and manufacture of suede fabrics for all purposes. Address replies, giving full particulars in confidence, to Mr. J. Young, care of The Federal Leather Company, Belleville, N. J.

BUSINESS OPPORTUNITIES

CUSTOM MILLING—EXPERT COMPOUNDING AND PROCESSING work for all requirements. The Honey Company, P. O. Box 453, Trenton, N. J.

WANTED: CONCERN WITH FACILITIES TO MANUFACTURE hard and soft rubber molded wheels. Price must be very reasonable. Address Box No. 23, care of INDIA RUBBER WORLD.

WANTED: EASTERN FACTORY DESIRING CONSIDERABLE volume in high-grade mechanical molded items. Address Box No. 26, care of INDIA RUBBER WORLD.

RUBBER FACTORY FOR SALE IN MASSACHUSETTS EQUIPPED for making spreader and saturated materials. Address Box No. 29, care of INDIA RUBBER WORLD.

THE ADMIAR RUBBER CO., 273 VAN SINDEREN AVENUE, Brooklyn, N. Y., solicits your inquiries for Mechanical Molded Rubber Goods, Hard Rubber, Sponge Rubber Tubing, and Specialties.

MISCELLANEOUS

WANTED TO PURCHASE: ONE COPY RUBBER CHEMISTRY & TECHNOLOGY, Vol. 1, No. 1. Address Box No. 22, care of INDIA RUBBER WORLD.

(*Advertisements continued on page 117*)

Foreign Trade Information

For further information concerning the inquiries listed below address United States Department of Commerce, Bureau of Foreign and Domestic Commerce, Room 734, Custom House, New York, N. Y.

No.	Commodity	City and Country
*3391	Rubber channels for automobiles	Calcutta, India
‡3442	Latex rubber	Johannesburg, South Africa
‡3460	Balloons, stationery supplies, and toys	Singapore, Straits Settlements
*3461	Elastic webbing	Lokeren, Belgium
*3476	Cotton elastic belts	London, England
*3482	Hose and packing sheets for fire brigades	The Hague, Netherlands
†3493	Heels, soles, and vulcanizers	Amsterdam, Netherlands
†3515	Insulated wire	Alexandria, Egypt
†3532	Battery boxes	Alexandria, Egypt
‡3539	Balloons and toys	Singapore, S.S.
*3576	Dress shields	Rio de Janeiro, Brazil
‡3587	Fountain pens and erasers	Cairo, Egypt
*3603	Garters and suspenders	Lima, Peru
¶3605	Druggists' sundries	Lima, Peru
*3608	Druggists' sundries	Tel-Aviv, Palestine
*3610	Automobile accessories	Toronto, Canada
†3617	Tape	Linkoping, Sweden
*3618	Tire valves	Shanghai, China
†3619	Suspenders and garters	Maastricht, Netherlands
*3620	Automobile accessories	Amsterdam, Netherlands
*3631	Hose	Guatemala City, Guatemala
*3667	Elastic	Sydney, Australia
†3677	Elastic roll-ons	Rotterdam, Netherlands
†3710	Aprons, pants, and water bottles	Santiago, Chile

*Agency. †Purchase. ‡Purchase and agency. ¶Exclusive agency.

Tire Production Statistics

	Pneumatic Casings		
	Inventory	Production	Shipments
1937	10,383,235	53,309,973	53,485,388
1938	8,451,390	40,182,392	42,330,072
1939			
Jan.	8,932,245	4,581,380	4,163,005
Feb.	9,572,553	4,343,513	3,738,696
Mar.	10,108,584	5,137,030	4,582,655
Apr.	9,997,527	4,211,152	4,355,584
May	9,918,759	4,418,072	4,753,403
June	8,909,495	4,869,862	5,750,149
July	8,300,126	4,510,122	5,055,637
Aug.	8,890,793	5,491,664	4,919,140

	Pneumatic Casings		
	Original Equipment	Replacement Sales	Export Sales
1937	22,352,601	29,886,326	1,246,461
1938	10,716,130	30,565,008	1,048,934
1939			
Jan.	1,685,190	2,353,822	123,993
Feb.	1,472,356	2,159,901	106,439
Mar.	1,746,999	2,719,450	116,206
Apr.	1,528,637	2,736,155	90,792
May	1,414,798	3,240,936	97,669
June	1,370,317	4,264,298	98,739
July	808,611	4,160,319	86,707
Aug.	610,771	4,198,410	109,959

	Inner Tubes		
	Inventory	Production	Shipments
1937	10,311,745	52,373,330	52,766,728
1938	8,165,696	37,847,656	40,292,614
1939			
Jan.	8,068,700	4,097,759	3,935,652
Feb.	8,414,652	3,680,521	3,334,791
Mar.	8,900,944	4,470,184	4,015,333
Apr.	8,837,313	3,841,308	3,927,033
May	8,839,536	3,847,827	4,154,39[illegible]
June	8,043,999	4,319,943	5,123,108
July	7,818,822	4,043,028	4,285,435
Aug.	8,238,406	4,918,165	4,432,396

Source: The Rubber Manufacturers Association, Inc. Figures adjusted to represent 100% of the industry.

New York Quotations

(*Continued from page* 108)

Stabilizers for Cure

Laurex, ton lots	*lb.*	
Stearex B.	*lb.*	
Beads	*lb.*	
Stearic acid, single pressed	*lb.*	$0.10 /$0.11
Stearite	*100 lbs.*	9.00
Zinc stearate	*lb.*	.23

Synthetic Rubber

Neoprene Type E	*lb.*	.65
G	*lb.*	.70
GW	*lb.*	.75
H	*lb.*	.78
M	*lb.*	.65
Latex Type 57	*lb.*	.30

Varnish

Shoe	*gal.*	1.45

Vulcanizing Ingredients

Sulphur		
Chloride, drums	*lb.*	.035 / .04
Rubber	*100 lbs.*	2.00
Telloy	*lb.*	1.75
Vandex	*lb.*	1.75
(See also Colors—Antimony)		

Waxes

Carnauba, No. 3 chalky	*lb.*	.37⅜
2 N.C.	*lb.*	.39⅞
3 N.C.	*lb.*	.37⅜
1 Yellow	*lb.*	.4575
2	*lb.*	.4425
Montan, crude	*lb.*	.11

Statement of INDIA RUBBER WORLD

Statement of the ownership, management, circulation, etc., required by the Acts of Congress of August 24, 1912, and March 3, 1933, of INDIA RUBBER WORLD, published monthly at New York, N. Y., for October 1, 1939.

State of New York }
County of New York } ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared B. B. Wilson, who, having been duly sworn according to law, deposes and says that he is the Business Manager of INDIA RUBBER WORLD and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: publisher, Bill Brothers Publishing Corp., 420 Lexington Ave., New York, N. Y.; editor, S. C. Stillwagon, 420 Lexington Ave., New York, N. Y.; managing editor, S. C. Stillwagon, 420 Lexington Ave., New York, N. Y.; business manager, B. B. Wilson, 420 Lexington Ave., New York, N. Y.

2. That the owner is: Bill Brothers Publishing Corp., Caroline L. Bill, Raymond Bill, Edward Lyman Bill, Randolph Brown, all of 420 Lexington Ave., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1% or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

B. BRITTAIN WILSON,
Business Manager

Sworn to and subscribed before me this 26th day of September, 1939.

[SEAL]

WM. A. LOW.

Notary Public Queens Co. No. 3180. Reg. No. 7501. Certificate filed in N. Y. Co. No. 825, Reg. No. 1L486.

(Commission expires March 30, 1941)

U. S. Crude and Waste Rubber Imports for 1939

	Plantations	Latex	Paras	Africans	Centrals	Guayule	Totals 1939	Totals 1938	Balata	Miscellaneous	Waste
Jan. *tons*	36,672	1,521	560	56	9	264	39,082	42,135	61	803	328
Feb.	34,185	1,463	289	348	3	252	36,490	46,980	45	685	54
Mar.	36,434	1,885	229	208	4	229	38,989	35,967	33	649	29
Apr.	27,991	784	487	142	1	196	29,601	30,807	65	275	246
May	44,015	2,167	413	761	7	172	47,535	27,410	78	759	151
June	33,956	1,489	318	42	3	139	35,947	26,011	107	680	7
July	33,211	2,511	456	292	..	269	36,739	22,918	46	884	104
Aug.	34,801	2,260	276	453	2	253	38,045	31,099	46	766	42
Total 8 mos., 1939 *tons*	281,265	14,080	2,978	2,302	29	1,774	302,428	....	481	5,501	961
Total 8 mos., 1938 *tons*	247,918	7,082	2,008	1,213	17	2,039	....	260,277	394	5,960	210

Compiled from The Rubber Manufacturers Association, Inc., statistics.

Dividends Declared

Company	Stock	Rate	Payable	Stock of Record
American Hard Rubber Co.	Pfd.	$2.00 q.	Sept. 30	Sept. 18
Detroit Gasket & Mfg. Co.	Com.	$0.25	Oct. 20	Oct. 5
Dow Chemical Co.	Pfd.	$1.25 q.	Nov. 15	Nov. 1
Firestone Tire & Rubber Co.	Com.	$0.25	Oct. 20	Oct. 5
Garlock Packing Co.	Com.	$0.50	Sept. 30	Sept. 23
General Electric Co.	Com.	$0.25	Oct. 25	Sept. 22
General Tire & Rubber Co.	Pfd.	$1.50 q.	Sept. 30	Sept. 20
B. F. Goodrich Co.	$5 Cum. Pfd.	$1.25 q.	Sept. 30	Sept. 22
Goodyear Tire & Rubber Co. (Can.)	5% Pfd.	$0.62½ q.	Oct. 2	Sept. 15
Goodyear Tire & Rubber Co. (Can.)	Com.	$0.62 q.	Oct. 2	Sept. 15
Hercules Powder Co.	Pfd.	$1.50 q.	Nov. 15	Nov. 3
Hercules Powder Co.	Com.	$0.40	Sept. 25	Sept. 14
Jenkins Bros.	Non-voting	$0.25 irreg.	Sept. 28	Sept. 14
Jenkins Bros.	Founders Share	$1.00 irreg.	Sept. 28	Sept. 14
Jenkins Bros.	7% Com.	$1.75 q.	Sept. 28	Sept. 14
Link Belt Co.	Pfd.	$1.62½ q.	Jan. 2	Dec. 15
Mansfield Tire & Rubber Co.	Com.	$0.10 extra	Sept. 20	Sept. 9
Mansfield Tire & Rubber Co.	Com.	$0.25 q.	Sept. 20	Sept. 9
Minnesota Mining & Mfg. Corp.	Com.	$0.65 interim	Sept. 30	Sept. 16
Plymouth Rubber Co.	Pfd.	$1.75 q.	Oct. 14	Oct. 2
Seiberling Rubber Co.	5% Pfd. A	$2.50	Sept. 18	Sept. 11

Classified Advertisements

Continued

MACHINERY AND SUPPLIES FOR SALE

CONSOLIDATED OFFERS: Hydraulic Presses, Calenders, Mixers, Mills, Tubers, Driers, Vulcanizers, Etc. Always a good deal on used machinery. Write to CONSOLIDATED PRODUCTS CO., INC., 13-16 Park Row, New York City.

United States Statistics

Imports for Consumption of Crude and Manufactured Rubber

	July, 1939		Seven Months Ended July, 1939	
UNMANUFACTURED—*Free*	Quantity	Value	Quantity	Value
Liquid latex (solids) .....*lb.*	6,572,567	$1,064,927	31,130,150	$5,177,005
Jelutong or pontianak....*lb.*	1,484,228	141,540	9,361,578	966,987
Balata ....*lb.*	87,353	18,813	813,626	117,276
Gutta percha ....*lb.*	308,606	43,742	1,826,097	277,247
Guayule ....*lb.*	335,200	32,626	2,655,400	235,112
Scrap and reclaimed.....*lb.*	1,187,237	16,805	6,650,976	118,459
Totals	9,975,191	$1,318,453	52,437,827	$6,892,086
Misc. rubber (above), 1,000 *lbs.*	9,975	$1,318,453	52,438	$6,892,086
Crude rubber......1,000 *lbs.*	76,805	12,071,105	556,445	86,559,422
Totals ....1,000 *lbs.*	86,780	$13,389,558	608,883	$93,451,508
Chicle, crude ....*lb.*	168,898	$55,161	11,016,852	$3,843,609
MANUFACTURED—*Dutiable*				
Rubber tires ....*no.*	1,136	$3,464	13,548	$67,819
Rubber boots, shoes, and overshoes ....*prs.*	2,472	787	8,130	2,819
Rubber soled footwear with fabric uppers ....*prs.*	55,951	10,656	452,496	85,827
Golf balls ....*no.*	7,224	985	444.077	45,028
Lawn tennis balls........*no.*	108,975	13,807	1,023,355	110,410
Other rubber balls.......*no.*	324,889	3,962	2,151,480	72,332
Other rubber toys.......*lb.*	24,510	3,607	179,261	28,676
Hard rubber combs......*no.*	21,216	1,672	478,785	35,771
Other manufactures of hard rubber	......	1,380	......	15,890
Friction or insulating tape.*lb.*	14,121	4,824	109,913	22,443
Belts, hose, packing, and insulating material.........	......	7,971	......	45,521
Druggists' sundries of soft rubber	......	5,660	......	38,907
Inflatable swimming belts, floats, etc. ....*no.*	20,066	915	519,287	32,610
Other rubber and gutta percha manufactures......	......	14,204	......	366,945
Totals	......	$73,894	......	$970,998

Exports of Foreign Merchandise

RUBBER AND MANUFACTURES				
Crude rubber ....*lb.*	985,110	$164,428	7,069,897	$1,133,128
Balata ....*lb.*	11,885	2,131	41,100	9,496
Other rubber, rubber substitutes and scrap.........*lb.*	......	......	139,355	8,472
Rubber manufactures (including toys)	......	1,867	......	13,567
Totals	......	$168,426	......	$1,164,663

Exports of Domestic Merchandise

RUBBER AND MANUFARTURES				
Reclaimed ....*lb.*	2,321,615	$120,333	12,734,802	$644,902
Scrap ....*lb.*	10,949,652	188,228	62,919,549	986,043
Cements ....*gal.*	44,886	57,543	305,828	380,365
Rubberized auto cloth.*sq. yd.*	13,892	7,773	100,929	53,051
Other rubberized piece goods and hospital sheeting..*sq. yd.*	186,388	73,273	1,643,988	622,265
Boots ....*prs.*	8,371	17,072	52,767	116,540
Shoes ....*prs.*	7,358	4,982	114,711	56,474
Canvas shoes with rubber soles ....*prs.*	31,428	20,787	368,542	251,596
Soles ....*doz. prs.*	3,154	7,038	26,377	55,551
Heels ....*doz. prs.*	25,151	15,102	268,062	146,794
Soling and top lift sheets.*lb.*	50,438	8,083	383,745	75,917
Gloves and mittens..*doz. prs.*				
Water bottles and fountain	7,888	17,738	59,745	130,381
syringes ....*no.*	30,758	9,964	147,452	51,959
Other druggists' sundries...	......	66,744	......	378,382
Gum rubber clothing....*doz.*	20,544	57,931	185,093	405,585
Balloons ....*gross*	31,150	25,202	238,537	180,970
Toys and balls.............	......	9,477	......	91,275
Bathing caps ....*doz.*	4,475	9,036	37,486	76,136
Bands ....*lb.*	15,714	5,710	157,347	64,473
Erasers ....*lb.*	23,861	14,056	175,783	95,461
Hard rubber goods				
Electrical battery boxes.*no.*	22,725	17,258	112,577	83,938
Other electrical ....*lb.*	22,315	6,415	156,206	45,519
Combs, finished .....*doz.*	15,079	8,816	105,066	55,808
Other hard rubber goods....	......	11,523	......	90,065
Tires				
Truck and bus casings.*no.*	21,817	425,708	175,793	3,414,041
Other auto casings....*no.*	49,565	446,669	434,418	4,466,094
Tubes, auto ....*no.*	51,050	86,714	422,763	672,003
Other casings and tubes..*no.*	8,794	76,292	76,229	582,755
Solid tires for automobiles and motor trucks....*no.*	417	8,296	2.152	27,261
Other solid tires.......*lb.*	13,989	4,352	119,213	25,215
Tire sundries and repair materials ....*lb.*	275,338	76,281	1,553,224	440,368
Rubber and friction tape..*lb.*	46,803	13,875	376,196	109,746
Fan belts for automobiles.*lb.*	51,454	29,486	370,893	210,640
Other rubber and balata belts ....*lb.*	213,843	122,131	1,710,375	936,260
Garden hose ....*lb.*	93.592	16,529	627,173	131,013
Other hose and tubing....*lb.*	452.633	179,406	3.284,648	1,251,914
Packing ....*lb.*	95,042	40,676	713,204	319,098
Mats, matting, flooring, and tiling ....*lb.*	77,956	9,748	746,129	114,898
Thread ....*lb.*	67,454	55,883	413,502	364,435
Gutta percha manufactures.*lb.*	190,752	54,322	891,001	259.715
Other rubber manufactures..	......	140,124	......	888,492
Totals	......	$2,566,576	......	$19,353,398

Rubber Questionnaire — Second Quarter, 1939*

	Long Tons			
RECLAIMED RUBBER	Inventory at End of Quarter	Production	Shipments	Consumption
Reclaimers solely (5).................	6,355	17,545	16,534	......
Manufacturers who also reclaim (16)..	6,418	13,097	1,878	12.215
Other manufacturers (104)...........	4,497	......	......	13,946
Totals	17,270	30,642	18,412	26,161

	Long Tons		
SCRAP RUBBER	Inventory	Consumption	Due on Contracts
Reclaimers solely (5)................	42,360	18,874	6,024
Manufacturers who also reclaim (15)..	32.408	15,330	6,969
Other manufacturers (13)............	379	......	......
Totals	75,147	34,204	12,993

Tons of Rubber Consumed in Rubber Products and Total Sales Value of Shipments

PRODUCTS	Rubber Consumed Long Tons	Total Sales Value of Shipments of Manufactured Rubber Products
Tire and Tire Sundries		
All types pneumatic casings (except bicycle, airplane)	63,691	$87,414,000
All types pneumatic tubes (except bicycle, airplane)	9,597	11,308,000
Bicycle tires, including juvenile pneumatics (single tubes, casings, and tubes)............	600	1,309,000
Airplane tires and tubes......................	51	268,000
Solid and cushion tires for highway transportation.	46	66,000
All other solid and cushion tires..............	90	261,000
Tire sundries and repair materials.............	2,913	3,203,000
Totals	76,988	$103,829,000
OTHER RUBBER PRODUCTS		
Mechanical rubber goods	8,173	$27,971,000
Boots and shoes	3,705	8,239,000
Insulated wire and cable compounds..........	1,130	†
Druggists' sundries, medical and surgical rubber goods	890	1,976,000
Stationers' rubber goods.....................	558	652,000
Bathing apparel	186	999,000
Miscellaneous rubber sundries................	894	1,951,000
Rubber clothing	120	425,000
Automobile fabrics	55	314,000
Other rubberized fabrics.....................	992	2,777,000
Hard rubber goods...........................	707	2,355,000
Heels and soles.............................	2,928	4,041,000
Rubber flooring	264	483,000
Sponge rubber	793	1,162,000
Sporting goods, toys, and novelties...........	578	1,978,000
Totals	21.973	$55,323,000
Grand totals—all products.................	98,961	$159,152,000

Inventory of Rubber in the United States and Afloat

	Long Tons	
	Crude Rubber on Hand	Crude Rubber Afloat
Manufacturers	86,746	8,986
Importers and dealers	39,261	39,336
Totals	126,007	48,322

* Number of rubber manufacturers that reported data was 176; crude rubber importers and dealers, 45; reclaimers (solely), 5; total daily average number of employes (reporting manufacturers and reclaimers), 132,008.

It is estimated that the reported grand total crude rubber consumption is 72.9%; grand total sales value, 80%; the grand total crude rubber inventory, 69.3%; afloat figures, unavailable; the reclaimed rubber production, 67.8%; reclaimed consumption, 62.6%; and reclaimed inventory, 74.9% of the total of the entire industry.

† Owing to the difficulty of securing representative sales figures this item has been discontinued.

Compiled by R.M.A. statistics.

Imports by Customs Districts

	July, 1939 *Crude Rubber		July, 1938 *Crude Rubber	
	Quantity	Value	Quantity	Value
Massachusetts	10,269,452	$1,685,502	6,475,463	$839,776
Buffalo	59,730	8,550	......	......
New York	50,755,297	8,066,918	38,579,199	4,523,018
Philadelphia	2,640,306	395,756	953,466	90,634
Maryland	1,550,479	230,095	125,470	14,307
Virginia	......	......	168,000	17,099
Georgia	827,947	118,199	......	......
Mobile	1,211,292	173,053	......	......
New Orleans	9,441,332	1,411,461	2,088,836	235,191
Galveston	55,869	8,576	......	......
El Paso	44,800	4,399	......	......
Los Angeles	5,331,835	840,359	1,468,613	167,411
San Francisco	1,507,144	223,103	705,720	81,989
Oregon	16,800	2,662	33,485	3,760
Ohio	167	25	......	......
Colorado	......	......	89,750	8,821
Totals	83,712,450	$13,168,658	50,688,002	$5,982,006

*Crude rubber including latex dry rubber content.